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COINCIDENCES AND SUPERSTITIONS.

BY R. A. PROCTOR.

(*Continued from page* 196.)

BUT when we have undoubted cases of coincidence, without the possibility of any real association (setting the supernatural aside), we have a problem of some interest to deal with. To explain them as due to some special miraculous intervention may be satisfactory to many minds, in certain cases; but in others it is impossible to conceive that the matter has seemed worthy of a miracle. Even viewing the question in its bearing on religious ideas, there are cases where it seems far more mischievous (as bringing ridicule on the very conception of the miraculous) to believe in supernatural intervention, than to reject such an explanation on the score of antecedent improbability. Horace's rule: "*Nec deus intersit, nisi dignus vindice nodus,*" remains sound when we write "*Deus*" for "*deus.*"

Now there have been cases so remarkable, yet so obviously unworthy of supernatural intervention, that we are perplexed to find any reasonable explanation of the matter. The following, adduced by De Morgan, will, I have no doubt, recall corresponding cases in the experience of readers of these lines:—"In the summer of 1865," he says, "I made myself first acquainted with the tales of Nathaniel Hawthorne, and the first I read was about the siege of Boston in the War of Independence. I could not make it out: everybody seemed to have got into somebody else's place. I was beginning the second tale, when a parcel arrived: it was a lot of odd pamphlets and other rubbish, as he called it, sent by a friend who had lately sold his books, had not thought it worth while to send these things for sale, but thought I might like to look at them, and possibly keep some. The first thing I looked at was a sheet, which, being opened, displayed 'A plan of Boston and its environs, showing the true situation of his Majesty's army, and also that of the rebels, drawn by an engineer, at Boston, October, 1775.' Such detailed plans of current sieges being then uncommon, it is explained that 'The principal part of this plan was surveyed by Richard Williams, Lieutenant, at Boston; and sent over by the son of a nobleman to his father in town, by whose permission it was published.' I immediately saw that my confusion arose from my supposing that the King's troops were besieging the rebels, when it was just the other way" (a mistake, by the way, which does not suggest that the narrative was particularly lucid).

Another instance cited by De Morgan is yet more remarkable, though it is not nearly so strange as a circumstance which I shall relate afterwards:—"In August, 1861," he says, "M. Senarmont, of the French Institute, wrote to me to the effect that Fresnel had sent to England in, or shortly after, 1824, a paper for translation and insertion in the *European Review*, which shortly after expired. The question was what had become of the paper. I examined the *Review* at the Museum, found no trace of the paper, and wrote back to that effect, at the Museum, adding that everything now depended on ascertaining the name of the editor, and tracing his papers: of this I thought there was no chance. I posted the letter on my way home, at a post-office in the Hampstead-road, at the junction with Edward-street, on the opposite side of which is a bookstall. Lounging for a moment over the exposed books, *sicut meus est mos*, I saw within a few moments of the posting of the letter, a little catchpenny book of anecdotes of Macaulay, which I bought, and ran over for a minute. My eye was soon caught by this sentence: "One of the young fellows immediately wrote to the Editor (Mr. Walker) of the *European Review*." I thus got the clue by which I ascertained that there was no chance of recovering Fresnel's papers. Of the mention of current Reviews not one in a thousand names the editor. It will be noticed that there was a double coincidence in this case. It was sufficiently remarkable that the first mention of a review, after the difficulty had been recognised, should relate to the *European*, and give the name of the editor; but it was even more remarkable that the occurrence should be timed so strangely as was actually the case.

But the circumstance I am now to relate, seems to me to surpass in strangeness all the coincidences I have ever heard of. It relates to a matter of considerable interest apart from the coincidence.

When Dr. Thomas Young was endeavouring to interpret the inscription of the famous Rosetta Stone, Mr. Grey (afterwards Sir George Francis Grey) was led on his return from Egypt to place in Young's hands some of the most valuable fruits of his researches among the relics of Egyptian art, including several fine specimens of writing on papyrus, which he had purchased from an Arab at Thebes, in 1820. Before these had reached Young, a man named Casati had arrived in Paris, bringing with him from Egypt a parcel of Egyptian manuscripts, among which Champollion observed one which bore in its preamble some resemblance to the text of the Rosetta Stone. This discovery attracted much attention; and Dr. Young having procured a copy of the papyrus, attempted to decipher and translate it. He had made some progress with the work when Mr. Grey gave him the new papyri. "These," says Dr. Young, "contained several fine specimens of writing and drawing on papyrus; they were chiefly in hieroglyphics and of a mythological nature; but two which he had before described to me, as particularly deserving attention, and which were brought, through his judicious precautions, in excellent preservation, both contained some Greek characters, written apparently in a pretty legible hand. That which was most intelligible had appeared at first sight to contain some words relating to the service of the Christian Church." Passing thence to speak of Casati's papyrus, Dr. Young remarks that it was the first in which any intelligible characters of the enchorial

form had been discovered among the many manuscripts and inscriptions which had been examined, and it "furnished M. Champollion with a name which materially advanced the steps leading him to his very important extension of the hieroglyphical alphabet. He had mentioned to me, in conversation, the names of Apollonius, Antiochus, and Antigonus, as occurring among the witnesses; and I easily recognised the groups which he had deciphered; although, instead of *Antiochus*, I read Antimachus; and I did not recollect at the time that he had omitted the m."

Now comes the strange part of the story.

"In the evening of the day that Mr. Grey had brought me his manuscripts," proceeds Dr. Young (whose English, by the way, is in places slightly questionable), "I proceeded impatiently to examine that which was in Greek only; and I could scarcely believe that I was awake and in my sober senses, when I observed among the names of the witnesses *Antimachus Antigenis (sic)*; and a few lines farther back, *Portis Apollonii;* although the last word could not have been very easily deciphered without the assistance of the conjecture, which immediately occurred to me, that this manuscript might perhaps be a translation of the enchorial manuscript of Casati. I found that its beginning was, "A copy of an Egyptian writing;" and I proceeded to ascertain that there were the same number of names intervening between the Greek and the Egyptian signatures that I had identified, and that the same number followed the last of them. The whole number of witnesses was sixteen in each. . . . I could not therefore but conclude," proceeds Dr. Young, after dwelling on other points equally demonstrative of the identity of the Greek and enchorial inscriptions, "that a most extraordinary chance had brought into my possession a document which was not very likely, in the first place, ever to have existed, still less to have been preserved uninjured, for my information, through a period of near two thousand years; but that this very extraordinary translation should have been brought safely to Europe, to England, and to me, at the very moment when it was most of all desirable to me to possess it, as the illustration of an original which I was then studying, but without any other reasonable hope of comprehending it; this combination would, in other times, have been considered as affording ample evidence of my having become an Egyptian sorcerer." The surprising effect of the coincidence is increased when the contents of this Egyptian manuscript are described. "It relates to the sale, not of a house or a field, but of a portion of the collections and offerings made from time to time on account or for the benefit of a certain number of mummies of persons described at length in very bad Greek, with their children and all their households."

(*To be continued.*)

THE CHEMISTRY OF COOKERY.

XXXII.

By W. Mattieu Williams.

SINCE the publication of my last paper, I have been told by a lady to whom the readers of Knowledge are much indebted that in the fatherland of potatoes, as well as in their adopted country, they are always boiled or steamed in their jackets; that American cooks, like those of Ireland, would consider it an outrage to cut off the protecting skin of the potato before cooking it; that they are more commonly mashed there than here, and that the mashing is done by rapidly removing the skins, throwing the stripped potato into a supplementary saucepan or other vessel, in which they may be kept hot until the preparation is completed.

Returning to the subject at the point where I left it I must endeavour to describe the effect of cooking on gluten. It is usually described as "partly soluble in hot water." My own examination of this substance suggests that "partially soluble" is a better description than "partly soluble" (Miller) or "very slightly soluble" (Lehmann). This difference is not merely a verbal quibble, but very real and practical in reference to the *rationale* of its cookery. A partly soluble substance is one which is composed of soluble and also of insoluble constituents, which, as already stated, is strictly the case with gluten in reference to the solvent action of hot alcohol. A very slightly soluble substance is one that dissolves completely but demands a very large quantity of the solvent. I find that the action of hot water on gluten, as applied in cookery, is to effect what may be described as a partial solution, that is, effecting a loosening of the bonds of solidity, but not going so far as to render it completely fluid.

It appears to be a sort of hydration similar to that which is effected by hot water on starch, but less decided.

To illustrate this, wash some flour in cold water so as to separate the gluten in the manner described in No. 29; then boil some flour as in making ordinary bill-sticker's paste, and wash this in cold water. The gluten will come out with difficulty, and when separated will be softer and less tenacious than the cold washed specimen. This difference remains until some of the water it contains is driven out, for which reason I regard it as hydrated, though I am not prepared to say that the hydration is of a truly chemical character, not a definite compound of gluten and water, but rather a mechanical combination—a loosening of solidity by a molecular intermingling of water.

The importance of this in the cookery of grain-food is very great, as any body who aspires to the honour of becoming a martyr to science may prove by simply making a meal on raw wheat, masticating the grains until reduced to small pills of gluten, and then swallowing these. Mild indigestion or acute spasms will follow, according to the quantity taken and the digestive energies of the experimenter. Raw flour will act similarly but less decidedly.

Bread-making is the most important, as well as a typical example, of the cookery of grain food. The grinding of the grain is the first process of such cookery; it vastly increases the area exposed to the subsequent actions.

The next stage is that of surrounding each grain of the flour with a thin film of water. This is done in making the dough by careful admixture of a modicum of water and kneading in order to squeeze the water well between all the particles. The effect of insufficient enveloping in water is sometimes seen in a loaf containing a white powdery kernel of unmixed flour.

If nothing more than this were done, and such simple dough were baked, the starch granules would be duly broken up and hydrated, the gluten also hydrated, but, at the same time, the particles of flour would be so cemented together as to form a mass so hard and tough when baked that no ordinary human teeth could crush it. Among all our modern triumphs of applied science none can be named that is more refined and elegant than the old device by which this difficulty is overcome in the every-day business of making bread. Who invented it, and when, I do not know, but perhaps Mr. Clodd can tell us. Its discovery was certainly very far anterior to any knowledge of the chemical principles involved in its application.

The problem has a very difficult aspect. Here are millions of particles, each of which has to be moistened on its sur-

face, but each when thus moistened becomes remarkably adhesive, and therefore sticks fast to all its surrounding neighbours. We require, without suppressing this adhesiveness, to interpose a barrier that shall sunder these millions of particles from each other so delicately as neither to separate them completely, nor allow them to completely adhere.

It is evident that if the operation that supplies each particle with its film of moisture can simultaneously supply it with a partial atmosphere of gaseous matter, the difficult and delicate problem will be effectively solved. It is thus solved in making bread.

As already explained, the seed which is broken up into flour contains diastase as well as starch, and this diastase, when aided by moisture and moderate warmth, converts the starch into dextrine and sugar. This action commences when the dough is made, and this alone would only increase the adhesiveness of the mass, if it went no further; but the sugar thus produced may, by the aid of a suitable ferment, be converted into alcohol. As the composition of alcohol corresponds to that of sugar, minus carbonic acid, the evolution of carbonic acid gas is an essential part of this conversion.

With these facts before us, their practical application in bread-making is easily understood. To the water with which the flour is to be moistened some yeast is added, and the yeast cells, which are very much smaller than the grains of flour, are diffused throughout the water. The flour is moistened with this liquid, which only demands a temperature of about 70° Fahr. to act with considerable energy on every granule of flour that it touches. Instead, then, of the passive, lumpy, tenacious dough produced by moistening the flour with mere water, a lively "sponge," as the baker calls it, is produced, which "rises" or grows in bulk by the evolution and interposition of millions of invisibly small bubbles of gas. This sponge is mixed with more flour and water, and kneaded and kneaded again to effect a complete and equal diffusion of the gas bubbles, and finally the porous mass of dough is placed in an oven previously raised to a temperature of about 450°.

The baker's old-fashioned method of testing the temperature of his oven is instructive. He throws flour on the floor. If it blackens without taking fire, the heat is considered sufficient. It might be supposed that this is too high a temperature, as the object is to cook the flour, not to burn it. But we must remember that the flour which has been prepared for baking is mixed with water, and the evaporation of this water will materially lower the temperature of the dough itself. Besides this, we must bear in mind that another object is to be attained. A hard shell or crust has to be formed, which will so encase and support the lump of dough as to prevent it from subsiding when the further evolution of carbonic acid gas shall cease, which will be the case some time before the cooking of the mass is completed. It will happen when the temperature reaches the point at which the yeast-cells can no longer germinate, which temperature is considerably below the boiling-point of water.

In spite of this high outside temperature, that of the inner part of the loaf is kept down a little above 212° by the evaporation of the water contained in the bread; the escape of this vapour and the expansion of the carbonic acid bubbles by heat increasing the porosity of the loaf.

The outside being heated considerably above the temperature of the inner part, this variation produces the differences between the crust and the crumb. The action of the high temperature in directly converting some of the starch into dextrine will be understood from what I have already stated, and also the partial conversion of this dextrine into caramel, which was described in Nos. 13 and 14 of this series. Thus we have in the crust an excess of dextrine as compared with the crumb, and the addition of a variable quantity of caramel. In lightly-baked bread, with a crust of uniform pale yellowish colour, the conversion of the dextrine into caramel has barely commenced, and the gummy character of the dextrine coating is well displayed. Some such bread, especially the long staves of life common in France, appear as though they had been varnished, and their crust is partially soluble in water.

This explains the apparent paradox that hard crust, or dry toast, is more easily digested than the soft crumb of bread; the cookery of the crumb not having been carried beyond the mere hydration of the gluten and the starch, and such degree of dextrin formation as was due to the action of the diastase of the grain during the preliminary period of "rising."

Everybody has, of course, heard of "aërated bread," and most have tasted it. Several methods have been devised, some patented, for effecting an evolution of gas in the dough without having recourse to the fermentation above described. One of these is that of adding a little hydrochloric acid to the water used in moistening the flour, and mixing bi-carbonate of soda in powder with the flour (to every 4 lb. of flour $\frac{1}{2}$ oz. bi-carbonate, and $4\frac{1}{2}$ fluid drachms of hydrochloric acid of 1·16 specific gravity). These combine and form sodium chloride, common salt, with evolution of carbonic acid. The salt thus formed takes the place of that usually added in ordinary bread-making, and the carbonic acid gas evolved acts like that given off in fermentation; but the rapidity of the action of the acid and carbonate presents a difficulty. The bread must be quickly made, as the action is soon completed. It does not go on steadily increasing and stopping just at the right moment, as in the case of fermentation.

I remember the first introduction of this about half a century ago, and the anticipations which accompanied it. London was agitated by the bread reform movement, and bakers were alarmed. A large establishment was opened in Oxford-street, and much amusement created by an opposition placard display in some of the neighbouring bakers' shops, "Bread sold here with the gin in it." This, of course, was fallacious, as the alcohol produced by the panary fermentation is driven off by the heat of the oven. Other methods similar in principle have been adopted, such as adding ammonia carbonate with the soda carbonate. The ammonia salt is volatile itself, besides evolving carbonic acid by its union with the acid.

In spite of the great amount of ingenuity expended upon the manufacture of such unfermented bread and the efforts to bring it into use, but little progress has been made. The general verdict appears to be that the unfermented bread is not so "sweet," that it lacks some element of flavour, is "chippy" or tasteless as compared with good old-fashioned wheaten bread, free from alum or other adulteration. My theory of this difference is that it is due to the absence of those changes which take place while the sponge or dough is rising, when, if I am right, the diastase of the grain is operating, as in germination, to produce a certain quantity of dextrin and sugar, and possibly acting also on the gluten. Deficiency of dextrin is, I think, the chief cause of the chippy character of aërated bread. It must be remembered that this stage is protracted over several hours, during which the temperature most favourable to germination is steadily maintained. Other and very interesting phenomena connected with bread-making will be treated in my next.

PLEASANT HOURS WITH THE MICROSCOPE.

By Henry J. Slack, F.G.S., F.R.M.S.

A VEGETABLE common now on the family dinner-table, rhubarb, readily affords to the microscopist spiral vessels of considerable beauty. A small piece of soft rhubarb may be taken from a well-cooked pie, and picked to pieces, under a low power, with needles inserted in sticks. The rhubarb should be so soft that most of its tissues are pappy. The spiral vessels are seen as fine threads, offering more resistance. They should be teased out of the surrounding tissue in a drop of water, and the refuse matter washed away. It is convenient to do such things under a dissecting microscope, but if the experimentor has not got one, a hand-magnifier, supported on a stand easily made with a piece of brass wire, will do nearly as well. If the rhubarb is in a raw state, it should be boiled in water to which a little caustic potash is added. A piece the size of a small pea will do for a couple of ounces of water. Only a small piece of the vegetable is required, say an inch long, cut into strips. A large test-tube does well to cook them in, or a small round enamelled iron soap-dish, sold by ironmongers, and much less likely to break than a porcelain one. As soon as a few of the thread-like vessels are drawn out they should be placed on a slide and examined with an inch or two-thirds objective. This will show whether they are good specimens, and if more cleaning from extraneous matter is required. When all right, and spread out to avoid entanglement, they may be allowed to dry on the slide. A drop of Canada balsam, thinned with benzine, should then be placed on a covering-glass and pressed down on the objects. The spring clips sold by opticians for this purpose will keep the cover down tight, and if the slide is put in a warm place it will be dry enough to examine in a few hours. It is well, however, to keep the clips on until the balsam is hardened.

Some of the spiral vessels may, before balsaming, be stained with carmine or hæmatoxylin, the colouring matter of logwood. They are prettier this way with ordinary illumination as transparent objects, but some should be mounted without staining, as they are best to examine with polarised light. The spirals make a splendid display of colours if their action on the light is assisted by selenite or by films of mica.

To understand the nature of these objects, cut a very thin horizontal slice off a rhubarb stem, and examine it with a low power. It will be seen that there are numerous darker patches distributed amongst the tissues of the transparent cells. Make a thin vertical section of the stem, and they will appear as long slender columns. Any one of them pulled to pieces by the needles will show that it is largely composed of the spiral vessels, some of which may be pulled out into threads. Vessels occurring in various plants in groups of this sort are known as fibro-vascular bundles. Some are kept open with the spiral thread, others are strengthened by deposits in patterns which give them a pitted, a dotted, or a stair-like (scalariform) appearance. Whatever may be their pattern, it is formed by growths that thicken the cell walls. The result may be a stout vessel or pipe, or, as in the case of some of the spirals, the cell walls may disappear, and leave the spirals as isolated coils of cellulose.

Spiral vessels are often so strong that when a plant-stem is torn they hang out as loose threads. A leaf-stalk of the great plantain, or stinging-nettle stem (*Plantago major*) shows them well; but the student should examine how these bundles are disposed in different orders of flowering plants, and in the underground stem of the brake (*Pteris aquilina*), a horizontal section of which shows the vessels in the eagle pattern which suggested its specific name.

At this season, the flowery banks and woods abound in the elegant Wood Sorrel (*Oxalis acetosella*), which the microscopist should not neglect. This plant owes its pleasant sharpness to small quantities of oxalic acid in its juices, and the leaves contain numerous patches of oxalate of lime. To see these to advantage, let a leaf or two soak in strong methylated spirit for four-and-twenty hours. This removes nearly all the chlorophyll and makes the leaf more transparent. Place a leaf so prepared on a glass slide, gently press it with blotting-paper to remove most of the alcohol, and then mount with thin Canada Balsam, placed as before described on the cover, and inverting that on the leaf. The oxalate is not found in well defined crystals, but in irregular patches, some extremely small, and others a good deal bigger. The way in which they are distributed amongst the cellular tissue is well seen with a magnification of about 50 linear, but to convert the leaf into an object of beauty requires polarised light, and selenite, or mica, as advised for the spiral vessels. The crystals should be seen as of a golden or silver tint upon a green or a dark chocolate ground, which is easily managed by revolving the polarising and analysing prisms until the desired effect is obtained.

THE MORALITY OF HAPPINESS.

A Study of the Scientific Aspect of Conduct and Duty.

By Thomas Foster.

(*Continued from page* 205.)

CARE OF OTHERS AS A DUTY.

I ENTER now on a portion of my subject where I shall seem less at issue with those who repeat with their lips, and fancy they hold in their hearts (though they never think of following in their lives) certain rules of conduct in which due care of self is treated as objectionable and evil is spoken of as not to be resisted but encouraged. I shall still be at issue with those who assert, apparently without thinking—certainly without alleging any reasons—that conduct and duty are not matters for scientific discussion at all, that they have no scientific aspect, and that such considerations as the progress and improvement of life, the increase of the fulness and happiness of life, and so forth, have no bearing whatever, and should have none, on our opinion as to what is right or wrong. But we may very well afford to disregard objections having so little relation to actual facts. Every one really guides his conduct in large part by such considerations as many thus allege to have no proper bearing on conduct; nor can any one draw a line beyond which such considerations must not operate: when any one has tried to do so, and perhaps imagines he has succeeded, then I shall simply meet his objection with the remark that he need consider what I have said and what I may hereafter say as only applying to such parts of conduct as he has admitted to be within the range of scientific discussion.

Let us take, now, the doctrine that while due care of self comes to each man, and indeed to every creature having life, as essentially *first*, yet due care of others—though second to due care of self—is as absolutely essential. The two are interdependent—and that to such degree that neither can exist without the other. The great difference

in the treatment which science has to extend to the two forms of duty—the egoistic and the altruistic—resides in this, that whereas in insisting on egoistic duties science is really insisting on what every normally-constituted man is already apt to attend to, in insisting on altruistic duties science is insisting on duties wofully neglected, despite the fervour with which they are verbally enjoined. Many reject egoistic duties in words, who look so carefully after their own interests in action, that those who inculcate due care of self as a duty are ashamed to have to admit such utter selfishness as among the results (the unwholesome fruits, as it were), of the process of development which conduct, like all things else, has undergone, is undergoing, and will ever continue to undergo. The truth is that the careful study of what may be rightly sought and claimed for self is no unworthy preparation for due thought and care of others.*

Let us briefly trace the development of altruism.

In many of the lower forms of animal life, the acts which tend to race maintenance are altruistic. The parent is sacrificed wholly or partially in the production of progeny. Nor even in the higher forms of life does this form of sacrifice disappear, though the very beginning of new existences may involve egoistic rather than altruistic relations. Unconsciously at first, but consciously afterwards, and later still by definite actions to that end directed, the mother of each new member of even the human race divine, sacrifices herself for her offspring. We may be said to imbibe altruism with our mothers' milk. Every act by which in babyhood our life was fostered was a practical exemplification of the doctrine that care of others is essential to the maintenance and progress of the race. To altruism each one of us owes life itself, and the human race owes its existence as certainly to altruism, though such altruism was secondary to egoism in its influence.

And note here, in passing, how development of conduct is related to this early altruistic care of the individual life. As certainly as a want of due care of self leads to the diminution of altruism, by causing those who are not duly egoistic to disappear from the scene of life and leave no successors or few, so does want of due care of others, in the nourishment and rearing of offspring, lead inevitably to the diminution and eventual disappearance of types not sufficiently altruistic. The careless unloving mother is unconsciously doing her part in eliminating selfishness from the world (the process however slow is a sure one), for the child she neglects shares her nature, and must thrive less than a child of happier nature nursed and cared for by a more loving mother. In whatever degree individual instances may seem to tell against this process of evolution, in the average of many cases and through many generations the law must certainly tell.

Nor is this law limited to the influence of the parent who has most to do with the earlier years of life. Throughout childhood and in greater or less degree to the hour and even beyond the hour when each man and each woman begins to take part in the duties of life, and in most cases in the actual struggle for life, development depends on cares which will be well bestowed by unselfish parents, and so tend to increase the amount and fulness of unselfish life, while the selfish will neglect them, and so unconsciously help to eliminate (in the long run) the more selfish natures. It must be so if there is any truth in the doctrine of heredity, and the doctrine is not only true but is universally recognised: it is scarcely more clearly and certainly recognised now than it was by those who in old times made the pregnant proverb, full of old-world wisdom and experience, "The fathers have eaten sour grapes, and the children's teeth are set on edge." Fathers and mothers who are selfish by nature rear with less care offspring who as certainly inherit their nature as the young of beasts of prey inherit the carnivorous tastes of those to whom they owe their lives. Hence, fortunately for the race,—seeing how many egoistic tendencies are apt to be fostered in the struggle for life,—a constant tendency to the elimination of the more selfish natures.

To this may be added the consideration that the ill-reared and unduly egoistic are less likely than those of more generous and altruistic nature to be found pleasing by those of the opposite sex, less likely therefore to marry, so that (speaking always of the average not of individual cases) there is yet another factor opposing the increase in number of the unduly egoistic.

Thus do we recognise on the one hand that within families a due degree of altruism is essential to the development of life and life's fulness, while on the other hand undue egoism tends directly in more ways than one to diminish happiness.

The best proof that such influence is exerted is found in the circumstance that in every advancing community the young are cared for with constantly-increasing care. Among savage races offspring receive few altruistic attentions. They are not reared in the full sense of the word. Almost from the beginning of their lives they have to take part in the struggle for life. In civilised communities they are cared for during many years, and they are better, more thoroughly, and more wisely, cared for, the more such communities advance. All this indicates and enables us to measure the development of altruism, so far as the family is concerned.

And that care of others in this case (*i.e.* within the family) is not only essential to the development of life and its fulness, but also to the happiness of self, will be clear if we consider the matter with the least attention. For the altruistic nature shown in the care of children is inherited by children and developed in them by such care. Hence, as Mr. Spencer well notes, there results such conduct on the part of children as "makes parenthood a blessing." Of the parent of children inheriting such natures and so reared, it may be said that, even in our days (to which the saying of the Hebrew Psalmist was not, I suppose, intended originally to apply), the man is blessed that hath his quiver full of them.* On the contrary, where the parents and therefore probably the children are of selfish nature, and the example set the children is unduly egoistic, parenthood is no blessing, and may well become a source of misery. What happens in this case? asks the philosopher whose treatment of the scientific aspect of duty we are following. "First the domestic irritations must be relatively great; for the actions of selfish children to one another and to their parents cause daily aggressions and squabbles. Second, when adult such children are more likely than others to dissatisfy employers, alienate friends, and compromise the family by misbehaviour, or even by crime. Third, beyond the sorrows thus brought on them, the parents of such children have eventually to bear the sorrows of neglected old age. The cruelty shown in extreme degrees by savages who leave the decrepit to starve, is shown in a measure by all unsympathetic sons and daughters to their unsympathetic fathers and mothers; and these, in

* Even the doctrine so many preach but so few practise "Care for others as for self," would be somewhat unsatisfactory if our care of self was insufficient; it ought then to run "Neglect the rights of others as you are careless of your own."

* So only that it be not so full as to give the little arrows but a narrow space to turn in; for so cannot the young idea be daily taught to shoot.

their latter days, suffer from transmitted callousness in proportion as they have been callous in the treatment of those around. Browning's versified story 'Halbert and Hob' typifies this truth."

We turn next from altruism in the family to altruism as an essential part of social conduct.

(*To be continued*).

HOW TO GET STRONG.

(*Continued from p.* 201.)

IF the muscles of the abdomen and loins are neglected, even by men, in this country (women cause *all* the waist muscles to become atrophied by carefully packing them inside corsets) the muscles at the sides of the waist are still more thoroughly overlooked. Of course, even in holding the body erect they are in some sort employed; but nothing is done to give them systematic work. Our sculptors, save as they follow Greek models, seem almost to have given up the idea that there are any side muscles to the waist; and certainly a man who should be seen in the bathroom with such muscles as the Greek sculptors show at either side of the waist, would be at once recognised as probably a professional athlete.

Yet these side muscles of the waist are of great importance. It is owing to their weakness that we so seldom see an erect and graceful carriage, especially in walking. If our women wobble in walking, as most of them do, it is chiefly because of the weakness of these muscles. Of course in their case stays are the true cause of the weakness, and they are for the most part to be pitied rather than blamed, since ninety-nine out of a hundred of those who have been brought up to trust in stays, are unable to get rid of them without an interval of discomfort which few are brave enough to undergo. But men (not being among those military monstrosities which "An Observer" once commended to our approval) can very readily correct this side weakness which so seriously impairs their gait. Alike in open air exercise and in indoor work, the proper means of correcting this weakness can readily be obtained.

Thus even in walking, if attention is directed to the uprightness of the body, especially when one side is loaded, as when a heavy hand-bag is carried, the side muscles get useful exercise. Hopping has been recommended as very useful for these muscles; but hopping is not an exercise which can be pursued with any great amount of zeal in public, especially by those who most need the steady development of the neglected waist muscles. A middle-aged gentleman hopping, as Mr. Blaikie recommends, half-an-hour at a stretch (on his way to his office for example) might conceivably attract some degree of attention. Even in a garden he might be suspected of kinship to that next door neighbour who exercised in this way his side waist muscles, on a wall, for Mrs. Nickleby's edification. Even the best way of carrying weights for the special purpose now in view, namely by shouldering them (which is also the easiest and most graceful) is not available for business men, giving too much the look of the hired porter. The superiority of the attitude artistically may be recognised by asking your graceful (though I fear corsetted) daughter to walk across a room with a jar poised on her shoulder, holding it above by the hand and arm curved into such a form as Miss Anderson has shown her, and afterwards asking the same young lady to carry the same jar across the room dangling by her side. But possibly a rather stout City man poising however gracefully a valise on his shoulder, would look less lovely, and might invite unpleasing comment from the ubiquitous street-boy.

But within the house even paterfamilias may attitudinise gracefully without attracting undesired admiration. The number of exercises available for increasing the development (but not necessarily the size) of the side muscles of the waist, is considerable, and most of these exercises are pleasing. Here is one. Place a hand palm upwards, under the cane seat of a light bedroom chair. Then raise your arm steadily till it extends horizontally —beside you, not in front. Now holding the body steadily but not too rigidly upright, raise and lower the hand with the chair on it, while with the other hand and arm you make graceful wavings *ad libitum*. Next, keeping the palm of the hand horizontal, bend the arm and hand so that the fingers point backwards. Then push the hand steadily upwards till your arm extends straight towards the ceiling. Lower the chair and revert to the former position, —arm horizontally extended beside you, — easily and lightly, keeping the other arm and hand moving freely and easily about, not resting the hand on your hips as you feel tempted to do owing to the strain on the weak side muscles of the waist on that side. Next go through the same movements with the other arm and hand. After a little practice, you may take a light chair on each hand, and go through the same movements with both at once. Skill in doing these exercises neatly and gracefully is worth acquiring in itself, and aiming at it makes the exercises interesting.

Lighter, but very pleasant and amusing exercise for the side muscles of the waist, may be obtained by throwing a light, soft ball (at first, or you may use a hard one if you have no objection to raps on the head) from one hand to the other over the head. The swaying motion of the body as you reach out to take the ball on one side and on the other gives capital work to the side muscles of the waist. Practise till you can throw the ball over the head and catch it without looking at it. This is not so easy to do, as it looks when done: probably before you attain certainty in the art you will find your waist muscles have been effectively strengthened and also limbered: for this exercise does both at once; one set of side muscles is tautened while the other is relaxed, and *vice versâ*.

Now for an exercise of a severer type.

Take the clubs one in each hand. Standing with the legs slightly apart, sway the clubs upwards towards the right, so that starting from being both near the ground in front of you they are swung till your arms are both directed some 45 degrees above the horizon the clubs touching each other and both pointing the same way as the well stretched arms which bear them. The body of course must yield to the sway of the clubs, and leans well over towards the right. Then sweep down the clubs in front of you (by which time the body has come upright) and over upwards towards the left, in the same position that they had before had on the right. Then back to the right, then to the left, the body swaying well over each time towards right and left as the clubs are alternately swung upwards on one side and the other. Note that at the end of each swing the face should be directed full towards the side to which the clubs have been swayed. Continue the exercise as long as you find it pleasant. The swaying motion is agreeable enough till you are getting tired, and the exercise is as pleasant as profitable,—unless you are awkward enough to catch your toes with either club, in which case you may desire a pause for rubbing and reflection,—the reverie leading to the resolution to avoid that error in future.

Putting up tolerably heavy dumb-bells, that is thrusting them straight upwards from the shoulder, is another exer-

cise admirably adapted to strengthen the side muscles of the waist. It is best to push them up alternately, and as each approaches its highest point to sway the body over towards the other side so that the upraised hand comes vertically over the other which should then be close to the chest. The upraised hand may then be lowered till it almost reaches the contrary shoulder. It is then brought to the chest on its own side, and the other hand is raised. And so on alternately. The steady swaying of the body from side to side in this exercise is at once pleasant and beneficial.

(To be continued.)

THE PERMANENCE OF THE DOMESTIC INSTINCT IN THE CAT.*

THAT the common cat would return to its primitive feral state, if a company of them of both sexes were turned loose in a region where they could have no access to mankind, is probable, and perhaps certain. But that the domestic instinct has now become an integral characteristic of the species, is a matter that will hardly be questioned by any one. Still, opportunities to test the real permanence of this instinct are often presented. I had the good fortune, however, to meet with an interesting opportunity of this kind during the prosecution of my field work for the U.S. Geological Survey in the summer of 1883.

In the prosecution of that work I made the journey, together with my party of three other persons, in an open row-boat, from Fort Benton, Montana, to Bismarck, Dakota, a distance of more than 1,000 miles; nearly 600 miles of that journey being through a region which has so few inhabitants that no post-offices were established there. The only white people in the region were a few buffalo hunters, and the woodman who supplied the few passing steamers with fuel, and even these persons were rarely seen upon our journey.

Upon making our camp one night, about 100 miles above Fort Peck, a good-sized black-and-white male cat came to the boat, and, although shy at first, soon manifested gratification at meeting us. I at first supposed that he belonged to some settler, but on examining the neighbourhood no trace of the recent presence there of white men could be detected. When we started upon our journey in the morning we left the cat on shore, but he followed along the bank, mewing piteously to be taken on board. The boat was headed for the shore, and as soon as it touched the bank the cat jumped on board, evincing delight at being in our company. For the next 100 miles he was our companion, and we became very much attached to him. He was extremely neat, and never soiled the boat in any respect while we had him. At times he would ask plainly, by such signs as he could command, to be set on shore; and then he would hurry back again for fear of being left. He was gratified with our attentions to him, and purred approvingly when we caressed him.

We would have gladly taken him to Washington with us, but as that was impracticable, we decided to leave him at the first place which should seem to offer him a good home. Upon reaching Fort Peck, which is now only an Indian trading-post, we found only one white man there, who was in charge of the store. To him we told the story of our cat, and begged him to give the wanderer a home. He consented, and upon going to the boat he at once declared our cat to be one which he, in company with a party of buffalo-hunters, had the year before taken to the place where we had found him. He said the cat was absent, probably on a hunt, when they broke their camp, and so Jerry, for that was the name we had given him, was left there, and had spent the year alone in the wilderness, hunting his own living.

Of course, I cannot say that Jerry had not associated with mankind in all that time, but the circumstances favour such a conclusion. If he had, after his abandonment, taken up with any settler, it seems hardly probable that he would have been so eager to join us. He seemed quite conscious that we would take him away from his haunt; and this shows that he had formed no attachment to either persons or locality there. The love of locality is doubtless more observable in the cat than the love of persons; while the reverse is true of the dog. Cats are never so demonstrative in their expression of attachment as dogs, and I suspect that the associations of human domesticity has much to no with the attachment to locality which cats manifest. It is true that Jerry was an unusually intelligent cat, and his case may be a somewhat exceptional one. But I cannot help thinking that there is yet much for us to learn of the psychology of this alleged well-known animal.—C. A. WHITE.

* From a paper by C. A. White, read before the Biological Society of Washington.

ELECTRO-PLATING.

III.

By W. SLINGO.

THE closing paragraph of the previous article declared the current to be of the same strength in all parts of the circuit. But we must not, as we pointed out, expect that if we pass a current from a given battery first through one electrolytic cell, and then through 50 similar cells, that in the second experiment we shall get 50 times the amount of decomposition wrought in the single cell. This amount is fixed definitely, and varies as the strength of the current. Thus, if in substituting 50 cells for 1 cell we were to increase the battery proportionately, we should get a 50-fold deposit. Increasing the number of the cells does not necessarily proportionately increase the current strength, which varies as has been previously shown as the ratio between the electro-motive force and the total resistance. Supposing, however, that we modify our battery so as to maintain a current of one ampère (or unit strength) in the circuit and pass the current first through one cell and then through 50 cells we shall in the second case deposit the same weight of metal in each cell as was deposited in the single cell. Two questions here present themselves. First, what amount of metal is a current of given strength capable of depositing in a given time? Secondly, will equal currents deposit equal weights of all metals? The answers are based on experimental as well as theoretical grounds. It has been found that a current of one ampère passing through acidulated water for one second of time deposits or sets free ·0000105 grain of hydrogen gas. As water contains one volume of oxygen to two of hydrogen, it follows that if they were both of equal weight, bulk for bulk, half the above quantity, or ·00000525 grain of oxygen, would be released. But oxygen has not the same weight as hydrogen, nor, in fact, has any other substance. A pint, quart, litre, &c., of oxygen weighs 16 times as heavy as a similar volume of hydrogen. Consequently, for every ·0000105 grains of hydrogen set free, $\frac{16}{2}$ or 8 times as much oxygen is evolved. An ampère thus liberates ·000084 grain of oxygen; 8 is known as the

chemical equivalent and ·000084 as the electro-chemical equivalent of oxygen.

Subjoined are the electro-chemical equivalents of such of the more important elements with which we may have to deal during the course of these articles :—

Copper	·0003307
Gold	·0006875
Iron	·0001470
Lead	·0010867
Nickel	·0003097
Silver	·0011340
Tin	·0003097
Zinc	·0003412

In other words, if a current of one ampère be passed through the various electrolytic cells for one second, the above fractions of a grain would be deposited.

If water be decomposed, and the resultant gases collected separately, and the two platinum electrodes be disconnected from the battery and joined to a galvanometer, the passage of a current will be evidenced. The gases have, therefore, a difference of potential which ceases as they reassume the combined or aqueous state. It will be apparent that if the separated gases have an electromotive force or difference of potential, the current which parts them must have a still higher electromotive force, otherwise no separation would ensue. For this reason weak currents may be passed through electrolytic cells without any apparent effect. The "back" electromotive force between hydrogen and oxygen is 1·45 volts, so that at least two Daniell cells are necessary to decompose water, the electromotive force of such a cell being only 1·079 volts. As the resistance of electrolytic circuits is never, under ordinary circumstances high, a few cells are therefore all that are required to overcome the electrical resistance of the circuit and the chemical affinities of the substances to be separated. Four volts (the EMF. yielded by two good bichromate cells) will, as a rule, be ample.

Having now secured an insight into the general principles governing electro-deposition, let us turn our attention to the practical application of those principles.

The more generally deposited metals are copper, silver, and nickel, of which the latter has recently made extremely rapid strides, more particularly since the dynamo-machine has been utilised to produce the necessary current. Copper is, however, the metal which will for the present engage our attention. It is manifest that in order to procure an equal homogeneous coating, the metal must be deposited regularly and uniformly. An unsteady and over-powerful current produces an extremely irregular surface and structure with the result that the copper is unmanageable and breaks to pieces or peels off the substance on which it may be deposited. Originally copper plating and typing operations were conducted on the single-cell process—that is to say, a Daniell cell* minus the copper plate was employed, the substance to be coated being substituted for the copper.

With small objects to be coated, this process may be easily adopted. Procure an earthenware or other non-conducting waterproof vessel of, say, a gallon capacity. Into this place a porous earthenware pot a little taller than the jar, and about 3 inches in diameter. In the porous pot place the zinc, which may be either in the rod or other convenient shape. If the experimenter has some odd pieces of zinc, he may easily cast a good electrode. There is often an objection to cast zinc, but the presence at the bottom of the cell or two or three ounces of mercury will soon put such matters right, more particularly if the zinc has been previously amalgated.* The casting may be in the form of a rod flattened out at the lower end. The zinc should, for nearly its whole length, be cast round a piece of stout copper wire, which serves the double purpose of supporting the zinc and providing an inexpensive means of connection. Instead of putting a copper plate in the outer cell, suspend the substance to be coated in a saturated solution of sulphate of copper, brine or some other saline solution being placed in the zinc division. On connecting the copper wire attached to the zinc with the suspended article a current flows from the zinc to the outer cell, and in passing through the sulphate of copper, splits it up, and metallic copper is deposited on whatever forms the negative electrode. One or two ounces of strong sulphuric acid should be added to the copper solution. The process is a slow one, and the size of the object is limited. It is still, however, often resorted to. A separate cell for deposition is better, and permits the use of batteries of other forms and of various strengths. In choosing our battery, a great deal depends upon the work to be done. If single small objects have to be coated, one Daniell or other cell will suffice; but where the object is large or where the shape is irregular, larger and stronger currents are necessary than can be obtained from such a source. To this subject, as well as to the preparation of the object itself, our attention must next be directed.

* A description of the Daniell cell and its action may be found in Knowledge, No. 83.

* This process has been previously described. See Knowledge, No. 88. The process consists in well washing the zinc in dilute hydrochloric or sulphuric acid, and then, the zinc being still wet, rubbing in a little mercury, which effectually homogenises the surface, and so prevents local action.

ICHNEUMON FLIES.

By E. A. Butler, B.A., B.Sc.

THE word "fly" is of extremely wide popular application; used for all sorts of dissimilar insects, it unfortunately frequently suggests affinities which do not exist. It would be an advantage if its application could be restricted to the flies proper, two-winged insects constituting the order Diptera, several representatives of which are household pests during the summer. The present insects have nothing whatever to do with the true flies, but belong to the Hymenoptera, the order that includes bees, wasps, ants, &c. They form a distinct and most remarkable section of this order, noteworthy for their slender make and strange habits of parasitism. They are the pirates of the insect world, maintaining their own existence by levying blackmail upon their fellow-creatures.

Airy, graceful, and sylph-like, they are yet so thin in body, long in limbs, and restless in habits that one is apt to regard them with some degree of suspicion as creatures possibly dangerous, whose too close acquaintance it may not be desirable to cultivate—an impression which is in some cases deepened by the formidable aspect of a long ovipositor. In slenderness of make they are without rivals in the insect world. They have usually long, narrow bodies; very long, slender, and tapering antennæ; long, slender legs; and four transparent wings, similar in texture and general form to those of bees, but different in the arrangement of the nervures, as will be seen by comparing Fig. 1 with the bee's wing figured in our first paper on Wild Bees. The abdomen is much pinched in at the waist, and attached to the thorax by only a very slender junction, through which all communication has to be kept up between the anterior and posterior parts of the body. It sometimes carries at its apex three

thread-like processes, which are occasionally even longer than the body itself (Fig. 2). These constitute the ovipositor, and consist of a central composite hard and stiff boring organ and its more flexible sheaths. The whole looks a formidable weapon, and the borer is indeed sometimes so hard and sharp-pointed as to be able to inflict a smart prick, but it is not a sting, *i.e.*, no poison gland is attached to it, and its main function is to make suitable perforations for the lodgment of the eggs and to guide them into their place of deposit. It is scarcely necessary to add, therefore, that it is an appendage to be found only in the females. The head carries the usual two masses of compound eyes, which are of large size, and suggest superior keenness of vision and a general wide-awakeness in excellent keeping with the rapidity of movements so characteristic of the insects. Between the compound eyes are the ocelli, or simple eyes, three small highly-polished knobs, triangularly disposed, and directed skywards.

Fig. 1.—Forewing of Ichneumon grossorius.

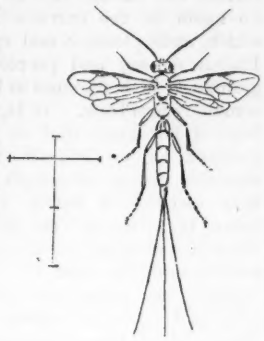

Fig. 2.—Glypta luguorina.

The majority of these insects are, in their earlier stages, parasitic upon the Lepidoptera, or butterflies and moths, which they usually seek in the caterpillar state. Having found a suitable caterpillar, the ichneumon fly mounts its back, and, bending its own body, brings its ovipositor down on the surface of the unsuspecting grub. By a little pressure the sharp point of the borer is driven through the poor creature's skin, producing, however, apparently, no greater discomfort at the time than a slight tickling sensation. The perforation made, an egg is inserted into the body of the victim sufficiently far to prevent the possibility of its removal with the skin when the caterpillar effects its periodical moults. Frequently a large number of eggs are laid in a single caterpillar, but in many cases only one is deposited, the number depending in large measure upon the size of the ichneumons they are destined to produce, a matter requiring careful consideration as the supply of food is limited to what is or will be contained within the body-walls of the caterpillar. From the moment of the insertion of the egg, the caterpillar is a doomed being, though for a long time there may be no premonitions of its fate. The ichneumon grubs, which soon hatch from the eggs, as soft, white, fleshy creatures with cylindrical bodies and without feet, devour the stores of fat laid up by their host, which it was intended to use in the elaboration of the additional organs of its own future form. These depredations, however, do not affect any vital part, and the creature goes on living, eating, and growing, while the insidious parasites are also flourishing upon the store of nutriment with which it unintentionally provides them. Matters go on thus until the ichneumon grubs are nearly ready to assume the pupa state, a period in their growth which sometimes almost synchronises with the corresponding state in their host. When this is the case, the latter has by this time begun to manifest symptoms of discomfort and disease, ceasing to eat, and becoming more and more feeble until it finally dies of exhaustion, when the parasites eat their way through its skin, and, on reaching the outside, form cocoons to protect themselves while in the pupa state, which they group round the carcase of the caterpillar whose vitality has now passed into their own bodies. So the development of the caterpillar is arrested before it can enter the chrysalis stage, and it therefore never fulfils its destiny. More generally, however, the ichneumon maggots do not mature quite so quickly, and the larva manages to pupate before they make their exit from its body. Still the result is in the end the same; the creature dies prematurely, never reaching the stage in which it can provide for the perpetuation of its race, and so passes away "without issue." Now, as the caterpillars of the Lepidoptera are almost exclusively devourers of vegetable substances, the ichneumon flies, by preventing their too rapid increase, become the saviours of vegetation, and may therefore be welcomed by the agriculturist. It is difficult to discover to how great an extent vegetation is preserved by these means; comparatively little attention has, until quite recently, been given to the ichneumons that inhabit this country, partly, no doubt, owing to the extreme obscurity of many species and their very close resemblance to one another. It is impossible to give an accurate estimate of the number of species we possess, as large numbers of new ones are being discovered year after year; still the number already recorded amounts to more than 2,000. Some of these are very abundant in individuals, and if we remember that every single ichneumon amongst the larger kinds, at least of those that prey upon the Lepidoptera, and every score or so of the smaller ones, means the destruction of a caterpillar, we can see what enormous accessions to their ranks the butterflies and moths would receive, if only the ichneumon flies were blotted out of existence. A large proportion of every brood is no doubt exterminated in this way, and the perils of larvadom amongst the Lepidoptera must indeed be great.

(To be continued.)

Reviews.

JOULE'S SCIENTIFIC PAPERS.*

THE Physical Society of London has conferred at least as much honour upon itself by the republication of these papers of Dr. Joule's as it has upon the great Englishman to whom science is so largely indebted for the establishment of the doctrine of the Conservation of Energy upon an irrefragable basis. Within the lifetime of many who will read these lines, heat was regarded as an actual physical entity; and the "Caloric" of the works published thirty or forty years ago must be well within the recollection of a considerable proportion of middle-aged men. That heat is merely the energy of motion was more than suspected by Rumford and Davy at the close of the eighteenth century; but it is practically in Dr. Joule's application of Faraday's magneto-electrical discoveries to illustrate the mutual convertibility of heat and mechanical motion, that the now universal acceptance of the Kinetic theory of heat had its origin. The mass of scientific papers reproduced in the 657 pages of the volume before us, commence, in the year 1838, with a description of a form of electro-magnet devised by the author; in fact, for the first four or five years of his

* The Scientific Papers of James Prescott Joule, D.C.L. (Oxon), F.R.S., &c. Published by the Physical Society of London. (London: Taylor & Francis.) 1884.

scientific life, Mr. Joule would seem to have mainly devoted his powers to research in electro-magnetism and Voltaic electricity. Soon, however, commenced that splendid series of investigations which will render his name imperishable until the decay of Physical Science itself; and the student of these pages will read at once with interest and admiration the description of the, seemingly, absurdly simple apparatus by the aid of which such mighty and enduring results have been attained. As may be gathered from the report of a lecture on pp. 265 *et seq.*, given by Dr. Joule, "On Matter, Living Force, and Heat," he had succeeded in establishing the Kinetic theory of heat as early as the year 1847. The popular exposition of that theory which he then gave might be transferred verbatim to any treatise in physics published during the present year. *Facile princeps* in the experimental investigation of thermo-dynamics, his collected essays on the whole subject must, perforce, be studied by every one who is desirous of a thorough insight into it. Naturally the results he obtained led him, among other things, to the discovery of the true theory of shooting stars, viz., that they are minute planetary, or *quasi*-planetary, specks of matter which ignite and are dissipated in vapour from the heat engendered by their friction against our atmosphere, as gravity draws them towards the earth; a theory since so abundantly confirmed. But while thermo-dynamical research may be held to have been the chief end of Dr. Joule's scientific life, yet his versatile intellect appears to have ranged far and wide over the field of physical science, and we find him observing, investigating, and experimenting upon such diverse subjects as the Velocity of Sound, the Utilisation of London Sewage, the Intensity of Light during a Solar Eclipse, Amalgams, Air-pumps, both compressing and (mercurial) exhausting, Mirage, the Fall of a Meteor, A New Balance, an Automatic Arrangement for Steering Ships, Sensitive Barometers and Thermometers, Solar Photography, an Abnormal Appearance Presented by the Sun at Sunset, Some Physical Properties of Beeswax, Hydrophobia, Kites, and Checking the Oscillations in a Telescope. Few men living are better entitled to exclaim with Horace, "Exegi monumentum ære perennius," than the author of this volume; whose noble, intellectual features are given in counterfeit presentment in the beautiful engraving which forms its frontispiece.

MR. BUTLER'S SELECTIONS.*

This remarkable and, in many respects, important work is primarily constructed on the principle of a sandwich, commencing as it does with amusing extracts from its author's former curious production, "Erewhon," and terminating with equally light and pleasant reading from his "Alps and Sanctuaries;" while between the two appear a series of Essays on Life, Psychology, and Evolution, which must be regarded as a contribution to biology that it will be impossible in the future to ignore or even to neglect. Within these two covers we may find material either to while away agreeably, and far from uninstructively, an hour in a railway-carriage, or to occupy all the thought and attention that the student can devote to it in the solitude of his own library. As "Erewhon" is a book which must by this time have been pretty widely read, it may suffice to say here that its author exhibits much of Swift's vigorous power of satire, without the coarseness which disfigures not a little of the work of the Dean of St. Patrick's. The chapter on "The Musical Banks" will probably require to be read over more than once before its allegorical signification will be fairly realised. When, however, such apprehension has been attained, the exceeding wit with which the idea is carried out cannot fail to commend itself to the reader. So again in the extracts from "Alps and Sanctuaries," which, amid pleasant and sparkling descriptions of North Italian scenery and people contain sententious and epigrammatic little passages to be committed forthwith to one's common-place book. It is, however, to our author's doctrine of Evolution that we would chiefly urge attention; destined, as we believe it to be, to work no inconsiderable change in accepted ideas. Mr. Butler contends that instinct is really inherited memory, and that there is a mental (as, merely as a matter of course, there is a physical) continuity between man—or any other animal—and his most remote ancestor. Moreover, he attributes the origin of species not, with the immortal Charles Darwin, to natural selection operating upon absolutely chance variations in existing forms, but to deliberate will and purpose on the part of the creature itself. Thus our author would say that the progenitor of the giraffe tried hard to bite the highest leaves on the trees; and so in process of generations lengthened its neck. If now, from any cause, a scarcity of leaves arose, such animals as could browse upon the higher ones would, of course, live on after the death of their less cervically favoured congeners, who had finished up all those at a lower level—and here, of course, the doctrine of natural selection would come in. We need scarcely add that this is substantially the doctrine of Lamarck and the elder Darwin in the last century. Professor Hering, too, may be regarded as the modern pioneer of the theory that instinct and ancestral memory are identical. This certainly invests the vague term "heredity" with a fixed and definite meaning which it does not otherwise possess. We will not, however, even attempt to summarise Mr. Butler's conclusions; trusting, as we do, that every one interested in the subject will study them in the original. A discussion with Mr. Romanes occurs as an episode in our author's exposition, in which, we venture to think, Mr. Romanes comes off very decidedly second best. *Inter alia*, we find Mr. Romanes quoting against Mr. Butler a statement as to instinct and inherited memory made by Canon Kingsley, in *Nature*, for Jan. 18, 1867, which well-meant advertisement, however, for a paper so conspicuously adorned by Mr. Romanes's own contributions, rather breaks down in the face of the fact that the first number of the periodical in question did not appear until some three years afterwards! We trust that the "Psalm of Montreal" will disappear from the inevitable second edition of this clever, thoughtful, and readable book.

* "Selections from Previous Works. With Remarks on Mr. G. J. Romanes's 'Mental Evolution in Animals' and a Psalm of Montreal." By Samuel Butler. (London: Trübner & Co. 1884.)

Sagacity of the Horse.—On my farm, one Sunday, the house was left in charge of one man, who sat on the porch reading. A mare, with her young foal, was grazing in the orchard near by. At length he saw the mare coming from a distant part of the orchard at full speed, making a loud outcry—a sort of unnatural whinny, but, as he says, more like a scream of distress than the natural voice of the horse. She came as near to the man as the fence would allow, and then turned back for a few rods, and then returned, all the while keeping up the unnatural outcry. So soon as he started to follow her she ran back in the direction of a morass or miry place which had been left unguarded, and only stopped on its very brink. The man hastened to the spot with all speed, and found the colt mired in the soft mud and water. It was already dead.—*J. D. Caton, in American Naturalist.*

MAP OF CONSTELLATIONS.

By Richard A. Proctor.

As an experiment, I give this week a map of those constellations which fall in the fourth map of my School Atlas, with the figures of the various animals or persons associated by the ancients with these star-groupings. Now that I have seen the engraving I recognise several improvements which can be conveniently introduced. The accompanying map must therefore be regarded as merely tentative. A series of twelve maps such as this, but improved and made more effective in various ways, will I think be valued by many students of the heavens, who, however little they care for the preposterous figures which sprawl over too many of our celestial globes and atlases, yet like to be reminded of the position which the ancients assigned to these strange celestial beings, and even find the poetry of the heavens incomplete without them.

Editorial Gossip.

In consideration of the kindness with which our numerous constituency have accepted the change of price (and size) which we have recently been almost forced to introduce, we propose, among other improvements (which will be arranged as quickly as they can be afforded), to have Knowledge printed on thicker and better paper. The paper ordered

for the purpose will be ready we are told by the first week in May.

We invite suggestions as to the series of Constellation Maps, of which a specimen is given this week. The object being chiefly to show stars and constellation *figures*, we believe the series will be much improved by the omission of all lettering, (even the names perhaps of the constellations), meridians, declination parallels, constellation outlines, and so forth. Then we think that outside the circular map the ground should be not altogether so dark as within the map itself.

THE FACE OF THE SKY.

From April 11 to April 25.

By F.R.A.S.

THE sun continues to exhibit interesting spots (though faculæ are fewer), and should, as heretofore, be looked at on every clear day. The aspect of the visible night sky is shown on Map IV. of "The Stars in their Seasons." Mercury is an evening star, and attains his greatest elongation east of the sun (20° 21′) in the afternoon of the 25th. About this time he may be caught with the naked eye over the W.N.W. part of the horizon after sunset. Venus is a splendid object in the evening and night sky, where she is travelling through Taurus ("The Stars in their Seasons," Map I.). On the night on which these notes terminate she will not set until about a quarter of an hour before midnight, a very unusual spectacle. Mars is visible all night, but is becoming a very small object now. He is still in Cancer (Zodiacal Map, p. 70). Jupiter should be looked at as soon as it is dark enough, as he is approaching the west. His angular diameter is diminishing, but he is still a noble object. The shading on his following limb (p. 102) is now quite obvious to the careful observer with the telescope. The planet is in the confines of Gemini and Cancer (Zodiacal Map, p. 40). A good many interesting phenomena of his satellites are observable during the next fourteen days, before 1 a.m. Beginning with the 14th, Satellite III. will reappear from eclipse at 7h. 53m. 34s. p.m., and Satellite II. be occulted at 10h. 17m. On the 15th the egress of the shadow of Satellite IV. will occur at 10h. 39m. p.m., and Satellite I. will disappear in occultation 50m. after midnight. On the 16th the shadow of Satellite II. will leave Jupiter's disc at 10h. 8m., at the same time that Satellite I. enters on to the opposite limb. This will be a pretty and curious sight. The shadow of Satellite I. will come on at 11h. 25m. p.m., and the Satellite casting it leave Jupiter's face at 12h. 28m. On the 17th Satellite I. will reappear from eclipse at 10h. 54m. 5s. p.m. On the 18th the egress of the shadow of this same satellite happens at 8h. 14m. in the evening. On the 21st Satellite III. will disappear in eclipse at 8h. 23m. 10s., travel through the planet's shadow, and reappear from eclipse at 11h. 53m. 55s. p.m. On the 23rd Satellite IV. will reappear from occultation at 8h. 15m. p.m. The ingress of the shadow of Satellite II. begin at 9h. 50m.; Satellite II. itself leaves Jupiter's opposite limb at 10h. 13m. p.m.; and Satellite I. enters on to the planet's face three minutes after midnight. On the 24th Satellite I. will be occulted at 9h. 15m. p.m.; while finally, on the 25th, this same Satellite I. will pass off the disc of Jupiter at 8h. 52m., followed by its shadow at 10h. 9m. p.m. Saturn has, for the observer's purpose, left us for the season, as has Neptune; but Uranus may be seen all night long. In the telescope he presents the appearance of a small bluish disc with an angular diameter of 4″. He is just to the north and west of β Virginis (Zodiacal Map, p. 165). The moon is 15·3 days old at noon to-day, and quite evidently her age will be 29·3 days at the same hour on the 25th. One occultation only—and that of a very small star—will happen during the next fourteen days. It occurs on the night of the 13th, when the star B.A.C. 5408, of the 6½ magnitude will disappear at the moon's bright limb at 11h. 54m. at an angle from her vertex of 57°. Its reappearance at her dark limb will not take place until 13 minutes past 1 o'clock the next morning, and will happen at an angle of 239° from her vertex. At noon to-day the moon is in the eastern confines of Virgo, out of which constellation she passes into Libra about 5 p.m. She is travelling across Libra until 6 o'clock in the afternoon of the 13th, when she enters the northern narrow strip of Scorpio. At 6 a.m. on the 14th she quits this for the southern part of Ophiuchus, her journey through which occupies her until 3 a.m. on the 16th, at which hour she enters Sagittarius. It is 5 p.m. on the 18th ere she leaves Sagittarius for the north-western portion of Capricornus, which it takes her until 9 o'clock the next morning to cross. At the hour last named she enters Aquarius, and is travelling through that constellation until 4 a.m. on the 22nd, when she crosses into Pisces. About 2 a.m. on the 25th she enters Aries, where she is still to be found when our notes terminate.

A correspondent of the *Daily News*, speaking on the erection of a telegraph line in China, says:—Little knots of people may frequently be seen gathered round a post listening with gaping astonishment, but with the fullest confidence, to some wiseacre who is pretending to explain the *modus operandi*. He tells them that there is a devil in each post, that the posts are placed close enough together for the devil in one post to make himself heard by the devil in the next, that the wire is placed on the top of the posts merely to keep them in an upright position; anything of a slant would make the devil inside feel very uncomfortable. These devils, of course, speak a language which is both unintelligible and inaudible to the uninitiated; "foreign devils," however, understand it well, and so to send a message is a very simple thing. A "foreign devil" speaks it to the devil in the first post, he passes it on to the next, and so it reaches its destination, where another "foreign devil" receives and interprets it. Other explanations are sometimes given, but all of them are equally wide of the mark.

According to *Kranick's Zeitschrift für Metallwaaren Industrie*, the introduction of steam into enclosed spaces for the purpose of extinguishing fire has been successfully tried in Berlin. The owner of a steel-pen factory in that city, in consequence of repeated outbreaks of fire in the drying-room, had steam pipes placed in three of the rooms, this appliance being shut off by short soldered pipes of an easily-flowing alloy of lead and tin, arranged to work automatically. One day a hissing noise made the fireman aware that one of these appliances had been called into action. It was found on investigation that the contents of the drying-room had become ignited, but that the steam thus set free had extinguished the fire before it could spread.

The Duty on Works of Art.—The Tariff Act of 1883 advanced the rate of duty on paintings in oil or water-colours, and on statuary, to 30 per cent. *ad valorem*, instead of 10 per cent., as it had theretofore been. The imports under this head for the fiscal year 1882 were 2,550,000 dols., and the late Tariff Commission recommended a duty of 40 per cent. Representative Perry Belmont, of New York, has now introduced a Bill wholly exempting from duty works of art, ancient or modern, the term to be construed as including all paintings, drawings, and photographs, and statues of marble or other stone. The argument favouring a high duty on this class of imports can have no other foundation than that such goods are brought here only by the rich, as luxuries, and for that reason should pay as high a revenue to the Government as possible. But there is another side to the question. Works of art are educators of the people, and, in public galleries or private collections, they exert a far-reaching influence in elevating the taste and exalting the ideals which touch the mainsprings of human life. No question of protection or of free trade can enter into any consideration of placing a duty on such products, for the American artists are strenuous supporters of the Belmont Bill, and the most of them, also, feel it a necessity of their education that their opportunities for studying European work, modern as well as ancient, shall be as free and unrestricted as possible. This, therefore, seems to be a case where we should adopt Goethe's saying, "Encourage the beautiful; the useful will take care of itself," to the extent, at least, of allowing artists' work to be imported duty free.—*Scientific American.*

"Let Knowledge grow from more to more."—Alfred Tennyson.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

All Editorial communications should be addressed to the Editor of Knowledge; *all Business communications to the* Publishers, *at the Office, 74, Great Queen-street, W.C.* If this is not attended to delays arise for which the Editor is not responsible.

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SUPERNATURALISM.

[1179]—Will you allow me to say, with reference to the allusion of one of your correspondents to Mrs. Crowe's "Night Side of Nature," that a book of that kind should not be treated too disdainfully. I do not think it possible for any one to read it through, *without prejudice*, and not feel that the authoress has taken a very great deal of pains to present her materials fairly; and without being a good deal surprised at the enormous amount of her material. Let it be granted—for the sake of the argument—that four-fifths of the anecdotes, since they depend on the veracity of the narrator alone, are comparatively valueless as evidence. There still remains a considerable number in which she has merely transferred, or condensed, from other sources of a more or less public character. I confess that, for my part, I am quite unable to regard all these as susceptible of any sort of rational explanation without the aid of mechanism totally different from that which the world at large recognises as human. I fear that I should esteem but lightly the mental calibre of one who could say he had read Mrs. Crowe's collection conscientiously, though without being one whit nearer a belief in the existence of some such mechanism. As for myself, the strange thing is that though I have been prepared, any time this last twenty years, to accept almost greedily any personal experience which could help me to the truth, I have never been a witness of, or accessary to, anything whatever of an apparently supernatural character. I remain, therefore, a sceptic in despite.

J. Herschel.

STRANGE DREAMS AND PRESENTIMENTS.

[1180]—It not unfrequently happens that persons who relate their sleeping experiences or waking impressions of things which have occurred or are about to occur, such as apparitions of deceased or dying friends, or of other circumstances which they could not possibly have known in the ordinary course of things, are regarded by many as visionaries or dreamers, merely, I believe, because such incidents are not common, and do not happen to all of us. The various cases of this nature which have come under my personal experience and observation have caused me to imagine that the state of the health and of the nerves of the individual who receives the impressions has much to do with it.

Ill-health, whether chronic or temporary, causes the bodily forces to be in subjection to the spiritual part of us, and thus draws aside for a brief period the veil which divides us from the world of spirits. The mesmeric forces (of which we scarcely know more than that they undoubtedly exist) may also have their influence in causing the stronger mind to act upon the weaker one, who involuntarily, even when at a distance, fulfils something desired by a person of stronger mind or will, and which could not possibly have been communicated to the receiver of the command except in the above manner.

I will now proceed to give some cases in point.

Many years ago, when suffering from severe illness which necessitated confinement to bed or sofa for several months, I perfectly remember lying for some hours in a most singular condition. It was not that of somnolence or exhaustion: I was aware that my body was there on the bed, but my spirit seemed to me to be for a time detached from it, to be in the world of space. During this interval I no longer felt any bodily pain; I was conscious also of the exact moment when the two portions of my being became again re-united.

Is it the mind or the spiritual portion of us which alone can suffer pain, either bodily or mental? In this case it was mercifully given as a period of recreation or refreshment to the bodily powers.

Some few years later, when living in lodgings in London, I awoke about 3 a.m. *en sursaut*, as the French say; that is to say, I suddenly found myself very wide awake, and sat up in bed. Whilst in this position, I heard a voice say, very distinctly, "One of your name is dead." When the first post came in, about 8 a.m., it brought the news of the death of a little nephew in India from diphtheria. The last accounts we had received of him, said he was a splendid, healthy child, of two years and a half; therefore I could have had no idea of his illness even—it was before the days of the telegraph to India.

Again, the child of a friend had had more than one attack of convulsions. I saw its parents one Sunday morn; they seemed quite cheerful about him, and said he seemed quite recovered, for the time at least. We did not meet again during the day. At the evening service I was startled by hearing the little one prayed for by name. I said to myself, "I cannot pray for that child's recovery; I know it is dead." On leaving the church my friend's nurse ran up to me begging I would go up to the mother at once, for the child was dead. As I afterwards learnt, it must have passed away almost at the exact moment that prayer was made in its behalf.

Once more. The day that H.R.H. the Prince of Wales was given over, during his severe illness some years ago, I was at a concert in a provincial town in England. A telegram which had arrived was circulated through the large hall from mouth to mouth to the effect that, "the Prince is dying; he cannot live many minutes." I felt certain that he would recover; some inward voice seemed to tell me so; nor is this the only instance in which I have had a similar experience.

All the incidents above mentioned occurred when I was not in a good state of health from the effects of our damp, autumn climate or other causes.

A very remarkable instance of a strong mind acting upon a weaker one was once related to me by a friend. He was taking his summer holiday in Scotland, and started off one morning for a long day on the moors. After he had gone a considerable distance it suddenly occurred to him that he had forgotten to give the mistress of the farmhouse where he was lodging a very important letter which he had written and intended to post that day. My friend said that this circumstance caused him much annoyance. On consulting his watch he found it would be impossible for him to catch the walking postman even were he to return immediately. He therefore resigned himself to the delay, and proceeded on his excursion, only returning to the farmhouse in time for a late dinner or supper. When he got back to the house, his landlady, on meeting him, said, "Oh, sir, I am so sorry you were at the trouble to return from your walk to remind me to give your letters to the postman. I should have done it without your coming back to beg me to do so."

Cosmopolitan.

APPARITIONS.

[1181]—As you are upon the subject of "Ghosts and Goblins," I venture to submit a simple theory, which, if admitted, would offer a rational account of some well-authenticated stories of apparition.

The brain is constructed in hemispheres, to which the double organs—eyes and ears and nostrils—correspond. It is not uncommon for a person to be blind in one eye, deaf in one ear, for some time before he becomes aware of the fact. I think it will not be questioned that some purely intellectual functions may be healthily discharged, while one hemisphere is structurally injured, as in hemiplegia.

Now, I suggest that this separate action of the hemispheres may be carried so far that one may be in the state of sleep and dreaming, while the other performs functions for the man consciously awake. If this be so, then the man, feeling himself awake, and seeing with certain eye the objects around him, will naturally suppose that he sees also the forms presented by the dreaming hemisphere. The vision will disappear as soon as the shock is sufficient thoroughly to awaken the dreamer.

This explanation would fall in with the facts that ghosts are most frequently seen at dead of night. In applying it to an explanation of well-authenticated stories, I have been struck by the fact that the visionaries have been reduced by continuance of long and hard work to a condition of great bodily exhaustion; the system has demanded the refreshment of sleep, yet some feverishness or strength of will has kept it at least partially awake.

This condition will be seen in the story referred to by Sir Walter

Scott, and explained by Mr. Lockhart, of a ghost, or rather apparition, seen by Lord Castlereagh. (Life of Sir W. S., Vol. VII., ch. 8, sub-anno 1822.)

It was also to be seen in a remarkable story told two or three years ago, with sober confidence, by Dr. Jessopp, in the pages of the *Athenæum*. He had gone through heavy work in the day, and was forcing himself to work late into the night.

It seems to me that I have also myself had experience of the conditions; probably most people have. I have lain awake, painfully awake, unable to get "a wink of sleep;" yet suddenly I have been startled with the consciousness of something just seen, said, or done which could only have been dream-work.

Is it not physically possible that one may be both awake and asleep at the same instant?

It may be that the suggestion I now make may have been made and dismissed before for sufficient reason. I can only say that my information in physiology and physics has not hitherto supplied me with such reason, and, therefore, I am bold enough to lay it before you, and, if you please, your readers.

Leonard H. Rudd.

[Mr. Rudd's idea seems to me well worth examining. I may note, as a curious point in connection with the duality of the brain, that my own experience suggests strongly that the sides of the brain act independently in such matters as recalling past impressions.—R. P.]

REMARKABLE FULFILMENT OF A DREAM.

[1182]—The following account of the fulfilment of a dream (which occurred to my mother several years back, but the memory of which is as fresh with myself as when it happened) may be interesting to your readers.

A quarrel had arisen between a certain gentleman (whom I will designate Mr. M.) and our family. Mr. M. had, up to that time, been one of our most intimate friends. Some time after this quarrel we were seated at breakfast, and my mother told us that she had dreamed that night she had seen Mr. M. in the High-street, and had conversed with him, but she had hardly gone two hundred yards from him when he dropped down dead. Whilst my mother was telling us this, one of my brothers, who had been out early that morning, came in with the news that Mr. M. had had a fit in the High-street at the very place where my mother had dreamed she had seen him fall. Mr. M. was taken home insensible and never spoke again. He died two or three days after he was taken ill.

E. L. R.

THE BLUE SUN.

[1183]—"L. S." is not right in supposing that the fine particles which scatter blue light would appear red if seen on the other side. The phenomena observed is due to the fact that particles the diameters of which are comparable with the wave lengths of the visible spectrum act differently with respect to the waves at opposite ends of the spectrum. A float would be carried up and down by ripples which were long compared with the diameter of the float, while a ship's buoy floating in the same water would hardly be moved by the ripples, because one ripple would tend to undo the work done by another. The float would give rise to secondary waves in the atmosphere corresponding in length with the distance between the crests of the ripples, while the buoy would give rise to no such waves in the air, but would reflect the ripples from its surface, and they would pass onwards in a different direction with a new wave front. The analogy is not quite perfect, but it will probably enable "L. S." to see how short wave lengths may be dispersed by small particles floating in the air, while the energy communicated by longer waves is chiefly absorbed in heating the particles. There is a flaw in "L. S.'s" reasoning with regard to the complementary character of reflected and transmitted light. If a body appears blue by reflected light, it does not follow that it will appear red by transmitted light. For example, ordinary blue glass appears blue when held opposite the sun, as well when held between the sun and the eye. Probably an experiment with regard to the light dispersed by small particles will make the matter clearer to "L. S." Let him dissolve a small quantity of shellac in spirits of wine, and pour a few drops of the liquid into distilled water; a fine precipitate will be formed, which, if held in the sunlight, appears blue, whether held opposite to the sun or in any other position. But the particles forming the precipitate are not blue, as "L. S." will discover, if he adds a little more of the lac dissolved in spirits of wine, and allows the liquid to stand till the precipitate settles—with ordinary shellac the precipitate is a bright yellow—which becomes visible directly the precipitate is seen *en masse* at the bottom of the liquid.

A. Cowper Ranyard.

A PAGE FROM THE MOON'S PAST HISTORY.

[1184]—There is reason to believe that in the condition of the moon we have clear indications of what our earth may one day become. Not indeed in appearance will the earth bear any resemblance to the moon; but in so far as the radiation of its heat into space, and the withdrawal of its oceans—and probably its atmosphere—into its interior, is concerned, it seems probable—nay, almost certain—that in the distant future the earth will bear the closest similarity to the present physical condition of its decrepit satellite.

That water formerly existed in large quantities upon the moon seems manifest when the evidence is fairly and impartially weighed. To make this sufficiently obvious, let us as briefly as possible endeavour to gather a little of her past history from the rugged pages of her surface markings. Apparently there is a significance not hitherto noted, so far as I know, in the arrangement and appearance of these evidences of early activity, when considered with reference to the question of lunar oceans.

The earliest record of volcanic energy lies unquestionably in those peculiar ray systems emanating principally from the "metropolitan crater" Tycho. This is placed beyond possibility of dispute by the way in which large craters, standing up on the line of direction of any one of these rays, are apparently tunnelled (I use this word advisedly, although quite aware of its insufficiency) by them. The region around Tycho would appear, from the numbers of mighty craters in its vicinity, to have occupied in earlier ages the weakest portion of the lunar crust, from whence resulted its inability to resist explosion, and its subsequent upheaval above the mean level of the moon's surface. With the progress of time, however, other craters were formed—some solitary, others in systems. Here and there, by these last (apparently when the energy of the older formation was exhausted), a second crater would break out so close to the first that that part of the wall of the first contiguous to the later formation would be broken and overthrown; but almost invariably the second formation is of smaller dimensions than the one superseded, showing at once the decay of the internal forces and the solidification of the moon's crust. These disturbances must have covered an enormous interval of time. It is reasonable to suppose that some of the smaller and later craters may have formed during the later period of the moon's existence as an inhabited world; or granting that such was not the case, but that they belonged to an earlier period, yet millions of years must have intervened between the formation of Tycho and Copernicus and the formation of the smaller craters.

A noteworthy feature of many of the lunar rings is the manner in which their walls are broken. This imperfection is usually upon their northern side, of which Fracastorius to the south of the Sea of Nectar is an example. It would seem that this peculiarity belonged to a period when the moon's crust was in a fit condition to be the abode of life—solid and sufficiently cool. For we have seen that the southern region was the region of greatest disturbance, whence it follows that the gases imprisoned in the moon's interior would, refused an exit elsewhere, be forced by the pressure of the contracting crust to this outlet. Manifestly these struggling gases in the course of their progress to the point of escape would alternately elevate and depress the various regions under which they passed. It will be easily seen that the vibratory wave-like motion thus resulting would raise the ground gently (comparatively speaking), and cause it to recover its position of rest, so to speak, with a jerk. This jerk would tend to overthrow that portion of a crater first elevated. Thus, if we suppose the underground forces of some northern zone to be seeking an outlet further south, it is obvious that the southernmost portion of the crater walls, being supported, as it were, by the sides, would be prevented from falling, whereas the northernmost, lacking such support, must collapse, granting the disturbing forces to be sufficiently strong, and the crater walls sufficiently weak for this purpose. This may be illustrated by experiment.

Assuming, then, the lunar disturbances to have taken place in the order detailed above, let us see how the question of water is affected by them. There is no reason to reject Mr. Proctor's opinion that the great plains upon the moon are either old sea-bottoms, or that the substances which last remained fluid, while the moon's surface was consolidating, were of darker materials than the rest. A very short study of the moon's surface will show that these greenish-grey plains seem to avoid the mountainous portion of the moon and to confine themselves to the lower levels. It will be noticed also that mountains, craters, or ridges of sufficient altitude in a number of cases determine their boundaries. This is precisely the required arrangement, upon the assumption that they are nothing more or less than old sea floors. Of course, it is possible that this greenish-grey tint marks the regions formerly occupied by molten matter. In this case, however, we must acknowledge that the lunar disturbing forces must have been exhausted long before the moon

occupied a stage of planetary life in anywise similar—so far as heat is considered—to the present condition of this earth. For example; a few craters stand upon these plains. If these craters belonged to the later periods when the moon's crust was solid it is not conceivable that they should be covered with this green tint—granting that the plains *were* formed by molten matter. On the contrary, the most likely supposition is that they would be surrounded by the whiter substance similar to that surrounding some of the older craters. Consider the case of Fracastorius, the incomplete ring already mentioned. If we are to suppose the formation and subsequent levelling of one portion of its wall to have occurred (as seems in the highest degree probable) in the order indicated, this molten matter must have remained in a liquid condition for years after the time when, in the ordinary course of nature, it should have solidified. Otherwise (which seems incredible) the breaking up of this fine structure must have occurred very shortly after the formation of the giant ray systems. But conceding that the grey plains are, in reality, dried-up sea-beds, it is manifest that, upon the overthrow of the wall, the water formerly laving the outer wall would find its way through the *débris* into the crater plain itself.

Such, then, are a few considerations anent the question of the former existence of lunar oceans. It seems probable that if careful measurements of the altitude of craters on and about the great plains were taken, much light might be thrown not only on the question I have briefly discussed, but it might be possible to determine approximately the depth of whatever liquid substance formerly lay there. J. R. Sutton.

OPTICAL PHENOMENON.

[1185]—Any one holding a red-hot poker and whirling it quickly round in a *dark* room will, after two or three turns, see a blue flame or light following in the circular path of the red-hot iron. I dare say this is a well-known and commonly-observed appearance, but I have never seen an explanation of it. S. E. De Morgan.

[Is not the bluish ring the complementary image of the red one—in other words, a subjective phenomenon?—R. P.]

FRUIT-TREES IN IRELAND.

[1186]—At page 197 of your paper of March 28, in Mr. Mattieu Williams's article on Cookery, I find the writer stating that when travelling in Ireland he was "surprised at the absence of fruit-trees in the small farms where one might expect them to abound." On speaking of this, he goes on to say, "the reason given was that all trees are the landlord's property; that if a tenant should plant them they would suggest luxury and prosperity, and therefore a rise of rent;" and Mr. Williams proceeds to express a hope that the passing of the Land Act will have put an end to such *legalised brigandage*.

I venture to think that Mr. Williams, if he must needs introduce political matter into a scientific discussion, ought to have made some inquiry as to the truth of the alleged facts. If the tenants to whom he spoke were leaseholders, the trees would have been their property, by the Irish Statute 23-4 Geo. III., cap. 39 (see Dr. Richey's "Irish Land Laws," 117), provided the tenants took the trouble of registering their plantations. If a tenant were not a leaseholder, then, under Mr. Gladstone's Act of 1870, he could claim compensation for improvements if his landlord "disturbed" him by raising his rent. Even under the law before 1870 the tenant was no worse off than in England, where trees are still "the property of the landlord," and we do not hear of any reluctance to plant. I do not know at what date Mr. Mattieu Williams "explored Ireland rather exhaustively," but I am surprised that a man of science should have overlooked a natural and physical difficulty in the culture of fruit-trees in this island. The climate, as every one knows, is always damp and often cold. The spring season, especially, is most variable, and at all seasons of the year steady sunshine is very rare. Surely this is sufficient to account for the scarcity of fruit-trees, without having recourse to any theory of "legalised brigandage." There are few subjects about which there have been more impudent mis-statements than this of the Irish law of Land Tenure. I do not ask you, or Mr. Williams, to study law, but I think I may fairly ask men of science, above all other men, not to commit themselves to statements of which they have not examined the evidence. I do not expect you, or Mr. Williams, to know that it is the habit of a certain political party in Ireland to attribute all the poverty and other misfortunes of the country to "Saxon misrule" and "landlord tyranny"; but I think I am entitled to expect that when men of science have a *vera causâ* of observed facts, in the shape of an ungenial climate, they will refrain from denouncing a class which has too many enemies already. In conclusion, sir, perhaps I ought to state that I am not interested in any way in Irish landed property, though I am interested in justice and fair play. I am neither landlord, land agent, nor agriculturist, and I am a tenant only as regards the house I dwell in. I append my name, address, &c., but not for publication. A Resident Irishman.

SCIENTIFIC MORALITY.

[1187]—It is with great pleasure that we read the articles on the "Morality of Happiness." They are more valuable than whole courses of ordinary University lectures on ethics and political economy; for persons of quite average ability may attend regular courses of such lectures, and yet neither learn the fallaciousness of popular altruistic theories, nor get hold of the true scientific principles of conduct now so admirably set forth by Herbert Spencer.

Ethical theories involve the most important issues; they may determine the whole course of a person's life. It is curious and interesting to look at some of the means adopted in order to carry out to their logical conclusion erroneous altruistic principles, popularly regarded as more sacred even than theological dogmas.

For those who have independent means, erroneous theories as to duty are not so very serious. Such persons will mostly confine themselves to agitation; they may, however, make some such experiment as that of Brook Farm, or may even, like Thoreau, in Walden Woods, retire somewhat from "unjust" civilisation, and go to prison rather than pay certain taxes. On the other hand, for persons who must labour for their subsistence, the task of reducing erroneous ethical theories to practice is a very serious matter. They will review the various occupations, putting most of them aside as "dishonest"—not for the benefit of every member of the community, but only for the advantage of the rich. Agriculture will be regarded as one of the most "honest" occupations, supplying as it does, most of the necessaries required by every one. Some of the able-bodied who wish to put in practice their theories, may for a time devote themselves to this occupation, probably on the free-grant land in the colonies, or they may squat on unsurveyed land, where they will not be troubled by taxes for purposes which they disapprove. They may, moreover, unite in communities, and form such settlements as those at Oneida, New Harmony, and elsewhere.

This is the peaceful side of the picture; though it may entail considerable suffering on the individuals themselves, yet it does little harm to society at large. But there is a dark side. Those who regard altruistic principles as rules for practical conduct, and who are without means, probably for the most part remain in large cities, living contrary to their principles by whatever occupation fortune may throw in their way. In their uncongenial pursuits they brood deeply over their supposed wrongs and the supposed tyranny of the rich. It is among such people that revolutionary ideas are readily propagated and conspiracies hatched. Socialists, Communists, and Nihilists are all most strongly imbued with altruistic principles, and yet many of these same persons are ready to overthrow civilization, regardless of the cost of life and suffering which it would entail. Hardly a week passes but we hear of some diabolical attempt to destroy life or property, all in the name of altruism.

If the popular altruistic theories are correct, Socialism and Communism are their logical results, and it is only by attacking the principles from which Socialism and Communism are deduced that these errors can be successfully combated. Attempts made by persons of altruistic opinions to combat Socialists are almost worse than useless, since they involve fallacious reasoning. The "Prophet of San Francisco" may indeed laugh to himself if he encounters no more redoubtable antagonist than some of those whom he has recently met.

Knowledge cannot be engaged in more important work than in diffusing scientific ethical theories. Scientific morality is the true antidote to revolutionary ideas. T. Common.

MAN IN THE GLACIAL PERIOD.

[1188]—Mr. R. B. Cook, in his article in Knowledge, of March 28, p. 199, says:—"It is now an acknowledged fact that man existed during the Glacial Period (the discovery of his tools and implements in Glacial formations having settled that question)."

Though several lines of argument point to this conclusion, I was under the impression that direct evidence was still wanting. Certainly such was Mr. Boyd Dawkins' opinion not very long ago. If Mr. Cook will kindly state the locality where these tools have been found in Glacial deposits, and give his authority, he will greatly oblige the writer of these lines. C. Kirkdale.

XUM

AN UNSOLVED TRICYCLE PROBLEM.

[1189]—Can any of your tricycling readers tell me why a rubber tyre leaves a double rut in dust, and a single one in mud? The fact is indisputable. The impression of the wheel has a small sharp ridge along its centre dividing it into two parallel ruts. I can hardly find any riders who have noticed it! Plenty have offered amusing suggestions, all hitherto inadequate. In extremely thin dust, the ridge is less perfect. In dust 2 in. deep, it is overwhelmed by the falling in of the sides. D. M.

ERRATA.

[1190]—Kindly allow me to correct a mistake of your compositor in letter 1174, p. 232, April 4.

"All-seeing" should have been "all seeing."

"Orthoscopic and pseudoscopic" should have been orthopic and pseudopic," as applicable to the phenomena indicated.

Orthoscopic and pseudoscopic are applied to certain phenomena produced in the stereoscope; the latter, when by interchanging the two stereoscopic pictures the effect is reversed,—the foreground seems to retire, and the background to advance, and the solid cube to become a hollow box, &c.—Yours, respectfully,

William Wilson, M.A., LL.D.

[We willingly insert Dr. Wilson's corrections. The first mistake was obvious. But we should like to know precisely what "orthopic" and "pseudopic" may mean. We changed the words ourself, though we know there is another technical meaning for the words we substituted. Our reason was that the words "orthopic" and "pseudopic" seemed to us impossible.—Ed.]

LETTERS RECEIVED.

J. Roberts. Anster's translation of "Faust," recently republished, we believe, by Macmillan, is a good one. But we should not like to say which is the best. *Fors Clăvĭgĕra* may mean either Club-bearing Fortune or Key-bearing Fortune,—*utrum horum mavis accipe:* the quantities are as indicated.—J. Rogers. The tide is not always at the same height midway (in time) between low and high tides; but there is no recognised difference between mid-height at neap and spring tides. On the average the mid-height would be the same at neap and spring.—Louisa Kennedy. I certainly regard the thirty-five guesses as happy hits only, and the pretended star-reader as a charlatan and a rogue, unless (which is unlikely) he chanced to be an idiot.—Zadig. The misprint at p. 191, 2nd col. 4th line from bottom, consists in the substitution of the word "area" for "side": of course if the diagonal of a square is 1, the area of the square, being half that on the diagonal by Euc. I., 47, must be ·5.—G. Lounak. If the last term of an arithmetical progression and the sum are all you know, you cannot possibly determine the arithmetical mean and the number of terms, seeing that there are any number of progressions having a given last term and sum.—Dædalus. Fear we could not give a list of works bearing on Aërostation.—Anxious. No occasion for anxiety; the Great Bear and the earth are all right, both of them. At 8 p.m. six months ago the earth was differently posed by half a rotation from her pose at the same hour now. Naturally then the Great Bear or any other celestial group appears half a rotation away, now, from the position she had, at the same hour, six months ago.—G. Williamson. Do not know where or how the large map of the moon by Dr. Schmidt of Athens is published. The British Association catalogue is I believe out of print.—W. J. P. I suppose because in St. Stephen's parish.—W. W. Saedtell. Distilled water would be more apt than any to give you a taste and more than a taste of the lead. I am no authority on the subject, but I should imagine that all such advice as was given in that article, like the elixirs of life which some folk promise, should be taken *cum grano salis*, not with lead, and with scruples of another sort.—T. M. I should say your New Geological Theory was very new indeed,—more new than true. I do not think it will be "criticised by scientific men."—R. Gerner. Many thanks, but we could not spare so much space for the manufacture of india-rubber. Our space does not possess india-rubbery elasticity.—Anderson. Cannot you sympathise with the effect of that great mystery, the existence of multitudinous wrong-doing, in such a mind as his? Confusion no softening, and what thinking man is there that has not been perplexed and confounded by that mystery?—Alice E. Wellson. Fear I said nothing about the decay which follows death, because I know nothing of that stage.—H. Garside, Jun. It is quoted in my "Universe of Stars," and in Mitchel's "Planetary Worlds."—W. H. Lloyd. The more I have tested Professor Loisette's system the more I value it.—H. C. Wilders. Fear can make no exception to the rule that we do not work sums. We really cannot afford the time.—G. St. Clair. Have unfortunately no available space for that subject.—T. H. I think "A. McD." meant—and would be understood to mean—by conscience only the internal recognition of a certain view in regard to doctrine. In all ages there have been but here and there two or three who have analysed conduct at all. The people in those ages *did* receive, through those who did the reasoning for them, the assurance that conduct conduces to happiness.—Early Reader. Secondary batteries have been applied to tricycles; but, so far as we are aware, only experimentally. Electro-motors for such purposes are but luxuries.—E. S. In the Brush machine those coils which are on the diameter of least inductive effect are automatically disconnected. The other coils are in one common circuit with the field magnets. The wire on the Griscom is about No. 20.

A very distinguished audience assembled at the Parkes Museum on Thursday evening, March 27th, to witness Mr. Watson Cheyne's demonstration of pathogenic micro-organisms. The chair was taken by Sir Joseph Lister, Bart. After stating that the great group commonly called Bacteria might most conveniently be subdivided into four classes—1, Micrococci (round bodies); 2, Bacteria (small oval or rod-shaped bodies); 3, Bacilli (large rod-shaped bodies); and 4, Spirochœtie and spirilla (rods spirally twisted)—and dwelling on the great variety as well as importance of the various parts played by this great group in the economy of nature, Mr. Watson Cheyne demonstrated numerous micro-photographs taken by Dr. Robert Koch, as well as some drawings by means of a lime-light apparatus. He observed that great differences existed among the various bacteria in their behaviour towards the human body; some could be injected without causing any injury; others could not grow in the living body, but could develop in dead portions of tissue and the secretions of wounds, giving rise to poisonous products. The true pathogenic organisms were able to attack the living body and multiply in it; they included the organisms which found entrance through some wound, giving rise to the traumatic infective diseases, and others which could obtain entrance without observable wound. Further, certain organisms, such as the *B. anthracis*, were capable of growing outside the body in dead organic substance; while others, such as *B. tuberculosis*, were apparently only capable of development in the living organism or under artificial conditions which reproduced to some degree those existing in the tissues of warm-blooded animals, though capable of long retaining their vitality in the dry state. With regard to the traumatic infective diseases, he thought that the most absolute proof had been furnished that the bacteria found in them, and nothing else, were the causes of the diseases; to establish such a proposition it was necessary that an organism of a definite form and with definite characteristics should always be found in the blood or in the affected part; the blood or the affected part, when inoculated into another animal of the same species, must produce the same disease; when the blood or the affected part was inoculated on a suitable soil outside the body the micro-organisms grew and must be indefinitely propagated on similar soil. When in this manner the organisms had been separated from the remains of the materials in which they were embedded, their inoculation in an animal must produce again the same disease, the same organisms being found in the diseased parts. These conditions had now been fulfilled with regard to anthrax, septicœmia of the mouse, erysipelas, tuberculosis, glanders, and acute pneumonia. With regard to typhoid fever, relapsing fever, cholera, and ague, the evidence was very strong, but not conclusive. Mr. Watson Cheyne concluded by dwelling on the importance of surrounding circumstances, chiefly those summed up in the phrase un-hygienic conditions, as concomitant causes of disease by preparing the blood for the attacks of these micro-organisms. The chairman, Sir Joseph Lister, dwelt upon the important fact that the organisms which produced particular diseases were only able to develop under very special conditions, instancing the bacillus, which caused septicœmia in the house-mouse, but which was unable to produce any deleterious effect on the field-mouse. He thought this fact, which showed that the very slight difference in the blood of these two animals was sufficient to alter the conditions favourable to the development of the bacteria, might prove of very great interest, as it was possible to conceive that by the administration of some medicines, sufficient alteration might be produced in the blood of the human system to kill off or to prevent the development of any special bacteria on the first appearance of the symptoms of the disease in the patient. Sir Joseph Lister concluded by referring at some length to the importance of Pasteur's researches on modified virus. Prof. Humphry paid an eloquent tribute to the great work which Sir Joseph Lister had already achieved, and looked forward with a large hope to the future of medicine.

Our Paradox Column.

We have received from Dr. Birley's solicitor a statement to the effect that proceedings have been instituted against Mr. H. Ossipoff Wolfson in regard to remarks respecting Dr. Birley in our Paradox Column, and a warning that (until such proceedings are decided, we presume) we should insert no further remarks of Mr. Wolfson's about the earth-flattening Parallax. We willingly accede to the suggestion, and we should even more willingly insert any counter-statements which Dr. Birley may desire to make. His silence as to details leaves us in doubt as to the particular remarks to which he objects or the particular statements which he denies. We find on reading over Mr. Wolfson's remarks that he describes the philosopher who uses the *nom-de-plume* (and *de guerre*) of Parallax, as being no other than the Mr. S. Goulden of 1849, the Mr. Rowbotham of 1864, who at another time went by the name of Tryon, and is now known—we had supposed—as Dr. S. Birley; he speaks of Parallax as one who claims to know how life is shortened and how it may be prolonged; he expresses the opinion that Parallax is not in reality master of these secrets; and he uses words implying that Dr. S. Birley is not a registered medical practitioner. We infer from the communication which has reached us that Dr. Birley is not to be identified with Mr. Goulden, or with Mr. Tryon, or with Mr. Rowbotham, or with the writer who under the name of Parallax has described certain rather singular and very doubtful experiments, who has advanced a theory of the earth's flatness, which to say the least is untenable, and who has issued a work claiming to show how men may attain patriarchal longevity. [Some of these circumstances in regard to Parallax have come prominently under our own notice, through the issue, by Parallax or his agents, of a circular (widely distributed at Memorial Hall on the occasion of Mr. Proctor's lectures) in which the Zetetic Astronomy and the treatise promising patriarchal extension of life were advertised, in company with a rather absurd account of a challenge to Mr. Proctor.] If Dr. S. Birley is not the same person as Mr. S. Goulden, Mr. Tryon, and Mr. Rowbotham, we shall hear with regret that we have so far wronged him. We supposed we had seen in a circular of the Balloon Society the name Dr. Birley definitely identified with that of Parallax as a lecturer for that society. But we must have been mistaken,—or there may be two Dr. Birleys, since there seem to be at least as many Parallaxes. Be this as it may, our columns are open to any statement Dr. Birley may wish to make here. Should we find we have done him injustice we will make the fullest apology. Or should he prefer to seek legal remedy we shall be well pleased, if we have done him injustice, to make such reparation as may be held right. But of whomsoever it may be who wrote and published the Zetetic Astronomy and the promise of extending life to patriarchal length, we must continue to assert our opinion in the clearest terms as occasion may arise. We regard this as a public duty, and it is a duty from which we assuredly shall not flinch.

Lastly, let me here for the moment abandon the editorial "we" and speak for myself, noting that I and I alone am responsible for whatever is said in these columns. If wrong has been done to Dr. S. Birley in identifying him with Parallax, apology and reparation will be made by *me* (though legal formality may appear to make the publishers responsible); if Parallax should even turn out to be no other than Mr. Goulden-Tryon-Rowbotham Birley, and if his public advertising of a treatise promising hundreds of years of life should be held to justify the unfavourable comments passed upon it, I shall still be most ready to insert any corrections he may have to make on Mr. Wolfson's statements, and to express my sincere regret for anything erroneous or misleading in them.

Richard A. Proctor.

Errata.—In both Mr. Wolfson's papers some words occur which need correction—though for a foreigner he writes excellent English. Among these are the words "recompensate" and "recompensation" for "compensate" and "compensation." It is hardly necessary perhaps to say that the word "can" in the tenth line from the bottom, p. 233, should have been "may," Mr. Wolfson's meaning being manifestly that the secret for prolonging life which Parallax claims to possess is not altogether to be trusted, and may tend rather to shorten life, as the best-intended prescriptions have been known to do. The warning is a very necessary one in all such cases, elixirs of life having sometimes proved very mischievous in their effects.—R. P.

Errata.—Page 230, col. 2, "Sydon" should be "Sydow." Same column and page, line eight from the bottom, "a map of cognate information" should be "a mass of cognate information."

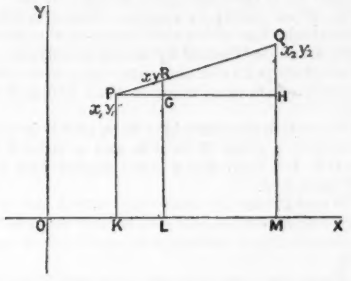
Our Mathematical Column.

EASY LESSONS IN CO-ORDINATE GEOMETRY.

By Richard A. Proctor.

(*Continued from page* 214.)

12. *To find the co-ordinates of the point dividing the straight line joining two given points in a given ratio, the axes being rectangular or oblique.*



Let P, Q be the given points; x_1, y_1 the co-ordinates of P, and x_2, y_2 those of Q. Suppose $m : n$ the ratio in which the required point R divides P Q, so that P R : R Q :: $m : n$. Let x, y be the co-ordinates of R. Draw P K, R L and Q M parallel to O Y to meet O X and P G H parallel to O X, to meet R L and Q M in G, and H respectively; then

$$m : n :: \text{P R} : \text{R Q} :: \text{P G} : \text{G H} :: \text{K L} : \text{L M},$$

that is $$m : n :: x - x_1 : x_2 - x.$$

Hence $$m(x_2 - x) = n(x - x_1),$$

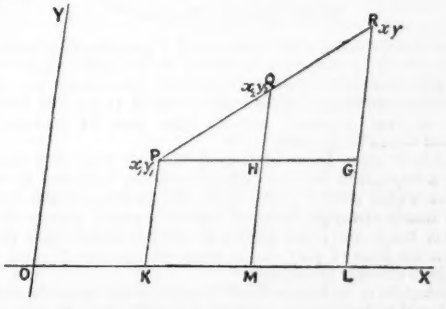
and therefore $$x = \frac{mx_2 + nx_1}{m+n};$$

and similarly $$y = \frac{my_2 + ny_1}{m+n}.$$

If P is at the origin, so that $x_1 = 0$, and $y_1 = 0$; then

$$x = \frac{mx_2}{m+n}, \text{ and } y = \frac{my_2}{m+n}.$$

13. *To find the co-ordinates, dividing the straight line joining two given points produced, so that the whole line thus produced bears to the part produced a given ratio, the axes being oblique or rectangular.*



Let P, Q be the given points; $x_1\ y_1$ the co-ordinates of P, and $x_2\ y_2$, those of Q. Suppose the straight line joining P Q produced to R, so that P R : R Q :: $m : n$, the given ratio. Let $x_1 y_1$ be the co-ordinates of R. Then with the same construction as in 12, we have

$$m : n :: \text{P R} : \text{R Q} :: \text{P G} : \text{G H} :: \text{K L} : \text{L M}$$

that is $$m : n :: x - x_1 : x - x_2$$

hence $$m(x - x_2) = n(x - x_1)$$

and therefore $$x = \frac{mx_2 - nx_1}{m-n}$$

and similarly $$y = \frac{my_2 - ny_1}{m-n}$$

Cor.—If P is at the origin, so that $x_1 = 0$, and $y_1 = 0$; then

$$x = \frac{mx_2}{m-n}, \text{ and } y = \frac{my_2}{m-n}$$

We see that these results differ from those of 12, only in the sign of n.

P Q in 12, is said to be divided *internally* in the ratio of $m : n$;

in the present 13, P Q is said to be divided *externally* in the ratio of $m : n$.

(*To be continued.*)

EASY RIDERS ON EUCLID'S FIRST BOOK.

With Suggestions for Solution.

Prop. 12.

32. Two straight lines are drawn from a given point. From another given point it is required to draw a straight line which shall cut off equal parts from the given straight lines.

33. From two given points on opposite sides of a given straight line draw two straight line which shall meet in that given straight line and include an angle bisected by that given straight line.

34. From two given points on the same side of a given straight line draw two lines which shall meet in that line and make equal angles with it.

35. A B, A C are two given straight lines, and D is a given point; it is required to find a point E in A B and a point F in A C such that the lines D E, F E shall make equal angles with A B, and the lines D F, E F with A C.

Notice that D *and* F *bear the same relation to* A B *that is investigated in* 34; *and in like manner* D *and* E *bear the same relation to* A C. *These considerations will suggest a construction requiring the use of Prop.* 12.

36. A B, A C are two given straight lines, and D is a given point so placed that the perpendicular from D on A C cuts A B. It is required to find a point E in A B and a point F in A C, such that D F and D E make equal angles with A C, and A E bisects the angle D E F.

Apply 33 *and* 34.

Prop. 13.

37. In the second figure to Prop. 13, if lines be drawn bisecting the angles A B C, A B D, these lines shall be at right angles to each other.

Prop. 14.

38. If there be three lines A B, A C, and A D meeting in a point, and if the lines bisecting the angles B A C, C A D are at right angles to each other, then shall A B and A D lie in the same straight line.

Our Chess Column.

EASY NOTES ON THE OPENINGS.

By Richard A. Proctor.

IN the Chess studies now commenced I propose to consider the game entirely from the point of view of the home Chess-player, who desires to play a sound and good game but not to devote more time than is reasonable to what (with him at least) is after all but a game, nor to take part in contests with recognised Chess champions.

The fault of most home players of Chess is that they open the game in a haphazard fashion and without any reference to certain principles which should guide us in the conduct of the opening, and will nearly always if followed lead to a sound game,—though, of course, there are cases known to all advanced Chess players, where certain lines of play which seem on the face of them sound enough lead directly to disaster.

The principle to be first noticed in opening the game is that the pieces should be brought as quickly as possible into effective action,—the Knights and Bishops first, and the Rooks generally next, the Queen, though she may sometimes be used with great efficiency even at an early stage, being usually kept in reserve and out of the way of mischief while the other forces are being developed. A sound player regards this question of development as influencing every move he makes. He is never troubled with the thought so often expressed by inexperienced players,—what can I do now? as though at any stage of the opening game there could ever be a position where there was not plenty of work in the way of developing the forces. Yet again, the question of development influences the sound player in estimating the value of each piece. He will not readily exchange a well-placed Knight or Bishop of his own against a Knight or Bishop of the enemy which has as yet no value derived from favourable situation. If the exchange is forced on him, he will perhaps prefer to make a developing move himself so that to the enemy is left the task of effecting the exchange, a new development of force perhaps following the return capture.

Now this question of the development of the forces at his command seems to have no existence for many players. They will think nothing for example of playing King's Bishop to Queen's third square to defend King's Pawn, when—the Queen's Pawn not having been as yet moved—they block by this one move Queen's Bishop, Queen, King, and Queen's Pawn,—partially blocking also the Queen's Knight which often comes effectually into play by Queen's second square.

Another principle of great importance is to avoid hasty attacks, or attacks which may be easily met by deploying moves on the part of the enemy. Bringing out the Queen over hastily is one of the ways in which inexperienced players run counter to this sound rule. They get her ladyship into positions of danger from which it may be difficult to extricate her. Even where she is not thus lost, or perhaps even seriously endangered, she may yet be repeatedly attacked by hostile pieces which at each attack occupy more favourable positions.*

Checking for checking's sake is another fault of the inexperienced,—purposeless checks being not only wasted but often leading to a most effective development of the hostile forces. Another vanity of the inexperienced is the bringing forth of Queen's Knight to attempt the forking check on adverse King and Queen's Rook—a plan easily defeated if necessary, but often most effectively allowed to culminate in success, by which a piece worth more at the beginning than the captured Rook is taken out of play, several moves wasted, and probably the fate of the all-important King sealed. I have no doubt every fairly good Chess player has repeatedly allowed this masterpiece of infantile Chess strategy to succeed when he has already given the odds of a Queen,—having a won game either when his Queen's Rook has been captured or but a few moves thereafter.

Passing over these forms of weak or unwise play, let us now proceed to consider a game commenced on the good old-fashioned line,— $\frac{1.\ P\text{ to }K4}{1.\ P\text{ to }K4}$ $\quad 2.\ \underline{Kt\text{ to }K\,B3}$. This is probably the best line for young players to open upon, and the best also for those who wish to train young players to start with. It introduces us most quickly to the practical consideration of sound rules of Chess play.

How shall the attacked King's Pawn be defended? Of course a counter attack may be made by attacking the first player's King's Pawn, either with King's Knight, constituting the powerful Petroff counter attack, with King's Bishop's Pawn constituting the Greco countergambit, or with Queen's Pawn. These replies will have to be considered later. But they are less suitable for the learner than the direct defence of the Pawn which we must now consider.

The King's Pawn may be defended by 2. P to KB3, a move which looks safe enough, but in reality scarcely defends the Pawn at all. For the Pawn may be immediately captured with the Knight, and if Knight be taken, a first player checks with the Queen, and Black's game is hopelessly compromised. If Knight is not taken, although Black can recover the Pawn by playing Q to K2, White will have far the better position. In fact it is a good general rule that the move P to KB3, on either side, is a bad one.†

The King's Pawn may also be defended by 2. KB to Q3. Of this move I have already spoken. It is contrary to all sound Chess principles, and leads to a disastrously cramped position on Black's part. White replies by 3. $\frac{B\text{ to }QB4}{Kt\text{ to }KB3}$, 4. $\frac{P\text{ to }Q4}{Kt\text{ to }QB3}$, 5. P takes P, and however Black may play White can maintain a superiority owing to the superior freedom of his men.

Thirdly, the pawn may be defended by 3. Q to KB3, a bad move, because the Queen is exposed to attack, and White's forces may be effectively developed while she is being driven hither and thither for safety.

But, fourthly, Black may defend his King's Pawn by 3. P to Q3, a defence rendered famous by the advocacy of Philidor. It is in my opinion the safest defence for the young player, especially in playing with odds against a stronger player. For though it retards the development of Black's men in some slight degree, yet it gives him a sound defensive position. If we consider carefully the various lines of play on which it has been shown that Black loses from the employment of this defence, we shall find that in every case his

* A favourite attack of the tyro is to play B to B4 and Q to B3 or R5, threatening the KBP which, however, is mere waste of time, as the P is easily defended. In the Scotch Gambit Q to R5 is sometimes played on the 4th move.—Mephisto.

† Except *when the King's Bishop is exchanged early in the opening*, as occurs for instance in the English Opening, where Steinitz introduced P to KB3 at an early stage.—Mephisto.

trouble arises from his attempting a bold attacking line of play after adopting at the outset a defensive policy. If he is thus in two minds as to his play, he naturally comes to grief; but if having instituted a defensive policy, he adheres to it, he can successfully maintain an equal defence, and when the opening attack against him is exhausted he will be found to have as good a middle game as his opponent.

White may now continue an attacking course by 3. P to Q4, or proceed to the steady development of his game by 3. B to QB4.

We will take the former course first. The game then starts

1. P to K4 / P to K4 2. Kt to KB3 / P to Q3 3. P to Q4 / P takes P 4. Q takes P.

Black may decline to take the proffered Queen's Pawn at move 3, playing either 3. Kt to Q2 which is sound, or 3. Kt to KB3 which is weaker, or 3. B to Kt5 which is much weaker.

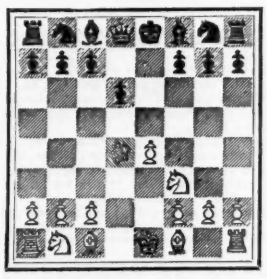
We shall consider these lines later, as also 3. P to KB4, Philidor's old line of play (by which he considered that Black got the better game); at present we follow what is probably Black's best play 3. P takes P, to which White may reply either by 4. Q takes P or 4. Kt takes P.

From the former line come the following line, which the student may severally follow as far as he pleases, making a good evening's study, the results of which he may with advantage commit to memory by playing several games out on these lines.

BLACK.

I.

1. P to K4 / P to K4
2. Kt to KB3 / P to Q3
3. P to Q4 / P takes P
4. Q takes P



The piece last moved is set sideways.

WHITE.

Position after White's fourth move (4. Q takes P.

4. Kt to QB3 / B to QKt5	B to Q2 / B to QB4	B to Q2 / B to KB4	B to Q2 / B to KKt5
5. B to Q2 / B takes Kt(a)	Kt to QB3 / Q to K3	Kt to QB3 / Q to Q2	Kt to QB3 / B takes Q
6. B takes B / B to KKt5	B to K2 / Q to QKt3	Kt to KB3 / B to Q3	Kt takes Q / Kt takes Kt
7. Kt to KB3 / Kt to QB3	White has the better game	B to K2 / Kt to QB3	K takes B / B to QB4
8. B to K2 / Castles Q side		Castles / Castles Q side	Kt to KR3 / Kt to QB3
9. Castles / Equal game		White has the better game	B to K2 / Equal game

(a) Staunton recommends here retreat of Queen to her square.

The second and third columns show that 4. B to Q2 is not so good a move as 4. Kt to QB3. But I am inclined to think that White does not do well to endeavour to avoid the retreat of his Queen; 5. Q to K3 seems to me better than 5. B to QKt5. There may, however, be objections to the move which I have not noticed.

(To be continued in next number but one.)

CORRECTION.—We regret to say that some mistakes have occurred in our last week's copy. There should have been a Black Rook on Black QB sq, when the ending would have read as follows:—1. R × Kt, RP × R. 2. Q × P, Q × Kt. 3. P to K5, P × Q. 4. P × B (ch), R to B2. 5. P × Q, and wins. In the game following, Black's 6th move should have been given as Kt to R4 instead of K4.

Our Whist Column.

A WHIST-PLAYER'S WAIL.

BY THE AUTHOR OF "BUMBLEPUPPY."

(*Continued from p.* 236.)

TO show that I am not making random accusations, I give three examples—there are others in stock, but these appear sufficient for my immediate purpose:—

I. "The cards are cut. In taking up the packs, I join the two packs, but leave one card on the table; this card would have been the middle, not the bottom card. I claim a fresh cut; my adversaries claim that it is a misdeal. Am I entitled to a new cut or not?" Answer, No. 1. "We think you cannot make your adversary cut a second time. We do not think that when you left a card on the table it could be said that there was any confusion in the cutting, and unless you can make out that what you did amounted to confusion in the cutting, it is a misdeal."

Answer, No. 2. "The claim is void. There is nothing in the laws or the custom of the table to make this a misdeal." Both these decisions are by the same authority. A more recent authority says, "According to the old rules, a misdeal might have been claimed; but not now, under Law 34." The explanation is ingenious, if not ingenuous; but it is open to the objection that, as the first decision is dated December, 1873, nine years after the present laws came into force, it is scarcely water-tight.

II. If A asked B whether he had any of a suit in which B had renounced, and B, instead of replying, turned and quitted the trick, and was subsequently brought to bed of one or more, his silence, combined with turning and quitting the trick, was ruled to be an answer in the negative within the meaning of the Law and he had revoked.

This is a decision of Clay's; and though disputed at the time, was the settled practice of Whist for fourteen or fifteen years.

Three or four years ago this decision was reversed, and authority has now taken its stand upon the literal interpretation of Law 74.

III. Some little time since my opinion was asked on this point. It was sent to me by a friend in Australia. "A and B *v.* Y and Z. Eleven tricks have been played. At the twelfth trick A leads a Heart, Y plays a Club, B plays a spade. Before Z has played, Y throws down his last card, which turns out to be a Heart. Has he revoked?"

Being mortally afraid of putting my foot in it, I much prefer to leave the mysterious borderland between sanity and insanity to experts in lunacy; however, in the sacred cause of friendship, I screwed up my courage, and, with considerable trepidation, gave an opinion to this effect. "It appears to me that Y certainly—this sounds unpleasantly like slang, but such is not my intention—revoked if the Club was a Trump, and, probably, if it was a card of a plain suit, for in playing his last card he either led or abandoned his hand, which has always been held to be an act of play establishing the revoke."

The question was next submitted to three of the best-known and most-respected authorities in this country—all champion deciders—whom we will call P. Q. R. P. replied, "Unless Clubs are Trumps I do not think Y. has revoked. He has not played again. He has exposed a card. If Clubs were Trumps I think he has played again (am not sure). The case is not sufficiently stated for a positive opinion."

Q. and R. did not regard it as insufficiently stated in any way, and they had no hesitation in saying that Y. had not revoked.

When by the next mail it turned out that Hearts were Trumps, when, consequently, the revoke was a shade more doubtful than before, while P. made no further sign, Q. and R. came to the unanimous conclusion that Y. had revoked. The authorities at the Antipodes who ruled originally that there was no revoke, remains in the same mind up to the present time.

Is this "vacillating and inconsistent," or is it not?

Here is a not very complicated difficulty—if only there was any agreement on first principles. We have,—

(*a*) A benighted outsider thinking a revoke is established, because a well-known decision overrides the law;

(*b*) An intelligent Colonist thinking it is not established, because he considers the law to override the decision.

(*c*) Authority No. 1 giving a somewhat uncertain sound, but on the whole inclining to the belief that it is either a revoke or it is not, evidently a man of judicial mind.

(*d.*) Authorities 2 and 3, while never in doubt for a moment, first affirming a thing to be white, and afterwards, when it has been bleached and is to some extent whiter than before, with unabated

confidence affirming it to be black; and there an important question, involving the highest penalty known to the law, rests.

If the force of absurdity can go beyond this, then "it can go anywhere and do anything."

The facts are in a nutshell. Either Y, when he threw his card up, abandoned his hand, or he did not. If he did, and *if that is an act of play which establishes a revoke*, then he revoked; if he did not, he had merely to say so, *cadit quæstio*; the card is an exposed one—"just that, and nothing more." Only we have one, or rather two little difficulties to get over. Does abandoning the hand establish a revoke? and, if it does, is the decision authoritative—that is to say, of compulsory obligation?

Who the original decider was, or who gave him authority to make a penal enactment in the teeth of Laws 58 and 73, I do not know. All I do know is that the decision must not be fathered on Clay, for his case 8, "*A* has revoked; *his claim of the game* and throwing down his cards must be held as against himself as an act of playing," is not on all fours; it occupies much firmer ground.

Here are two well-matched decisions, "Silence is an answer." "Throwing down the cards establishes a revoke,"—of course, with the proviso that one has been made—both strain the law; both entail the revoke penalty; the only difference is that one is in the *ipsissima verba* of Clay, the other is a mangled excerpt; if the strong one has been quietly and surreptitiously burked, why, in the name of ordinary patience, does the weaker survive?

If decisions are retreating all along the line to a safer standpoint on the letter of the law, well and good; only tar them all with the same brush, and take some means to let the public know it.

Before the lamented demise of the Westminster Papers, disputed points were argued at length; whether in the number of counsellors there was wisdom, or whether too many cooks spoiled the broth, in either event we heard both sides. Question and answer could be found together, and if the decision did not invariably commend itself to our intelligence, we at any rate knew what the decision was, and that was the main point; but now our position has changed greatly for the worse. The present practice of Whist—a direct incentive to gambling—is this; whenever any doubt arises, instead of being able to lay their hands upon the recorded decision and settle it at once, the parties concerned first make a bet of one or more sovereigns and then write to the *Field*. On the ensuing Saturday afternoon a certain amount of money changes hands; two people are wiser, but the increase of wisdom is confined to themselves, and at the very next table the same process is repeated; while numerous quiet, well meaning people like myself, who never bet, never know anything at all; for such answers as these, "X. It is a revoke," "A. S. S. You cannot call on Z to pass it," partake very much of the nature of Valentines in that, however interesting they may be to the recipient, they arouse no corresponding emotion in the world at large.

(To be continued.)

SOLUTION OF DOUBLE DUMMY ENDING, p. 193.

1. *B* plays C. *A* puts S. Ace. Won by *A*.
2. *A* plays D Ace. Won by *A*.
3. *A* plays S 2. Won by *B*.
4. *B* plays S K. *A* discards D. Won by *B*.
5. *B* plays C. *A* discards D.

And *Y* must discard either D or H, and *B* plays accordingly.

Correct solutions received from E. F. Lewin, Q. T. V., W. H. M., A. V. Merriman, J. Hartop, M. M. L., John Martindale, A Whist Student, C. D. V. We invite those whose solution differs from the author's to examine the problem afresh.

E. W. Y.—The play of Queen second hand from Queen and another not in sequence is almost universally rejected by Whist-players. You say *even* the King may be played. The old saying was King ever, Queen never. Then came Mr. Clay's rule, King in trumps, small card in plain suits. Now the generally-accepted rule is, Never play the honour from King or Queen and a small card unless for a special purpose, as to get a lead. It would have paid *Y* no doubt in the game at p. 216 to have played Queen to trick one. But it would have been bad play all the same.

Wm. Jacobson.—We do not undertake to decide questions relating to the laws of Whist and their operation. Our Whist papers, games, &c., are intended rather for home players than for those who are likely to be much interested in "decisions." Still there can be no objection to our answering your questions. Undoubtedly an exposed card is only one which can be called when playable without revoke, not one the playing of which can be forbidden. Opponents may defer calling for the exposed card as long as they please, but they cannot prevent its being played when they do not call for it.

A. J. E.—You should certainly cover Queen led with Ace, second hand, unless you have reason to think your partner probably holds the King,—as when third player has discarded from the suit. In the latter case it is better to hold up the Ace. Suppose, for instance, you hold Ace and two others, second hand, and third player has discarded from the suit,—then the lead is presumably from strength, Queen, Knave, Ten, and another, and the chance is small that third player has helped to unguard King: therefore your partner probably holds King; but if he does not, you are still sure of not being ruffed second round, and if third player discarded from King two little ones, your Ace will catch the King on the second round of the suit.

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